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The Farmer's Digest

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The Farmer's Digest

Volume 5 May, 1941 Number 1

Feed from the Air!

Condensed from Successful Farming

Niemen Hoveland

THEY'RE feeding cows partly on air, as it were, at the University of Wisconsin. And before long it is not unlikely that thousands of farmers will be following suit.

Not that good farm grains and roughages are going out of the picture. But expensive protein supplements? For them there is now a good, cheap substitute—at least so far as cattle and sheep are concerned.

The substitute is urea, made in industrial plants, mostly from nitrogen taken out of the air. This form of nitrogen has been used as fertilizer for years, but the idea of feeding it is just beginning to take hold. It sells for about one-fourth to one-third the price of the protein feed it replaces.

"There's no doubt now that cattle make use of urea," says E. B. Hart, Wisconsin biochemist, who, along with I. W. Rupel, Gus Bohstedt, and M. I. Wegner, is testing the "ersatz" protein.

"Cows getting urea in a low-protein ration for 32 weeks milked just as well as comparable animals fed linseed oil meal in the same ration. The urea group milked considerably more than one getting the low-protein ration alone, without urea or oil meal.

"Now, in another long trial, urea again is giving a good account of itself. And before we started this work with dairy cows, we had good results with urea in calf rations over a three-year period."

The country over, this news is getting attention. A number of experiment stations are following Wisconsin's lead in trying urea. Milling companies are getting ready to put it into commercial feed. Some dairymen already are mixing their own urea rations, and reporting good results.

Urea-fed cows have stayed in good condition and calved normally in the Wisconsin experiments. There seems to be no

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danger that urea will injure animals unless it is fed in needlessly large amounts.

A little urea goes a long way. Three pounds of it with 97 of farm grain makes a feed containing as much nitrogen as the usual 18-percent-protein dairy mixture —and that's enough, even if the rest of the ration consists of timothy hay and corn silage. The reason is, urea contains 46 percent nitrogen, while a good protein supplement such as linseed oil meal has only about seven percent.

How much can a farmer save by feeding urea?

"I did a little calculating on that some time ago," says Hart. "I found that, at the market prices of early 1940, a feed made up of three pounds urea, 48½ of corn, and 48½ of oats cost exactly a dollar a hundred. For a linseed oil meal mixture that would do the same job, you would have to use 34 pounds of oil meal, 32 of corn, and 32 of oats at a cost of $1.22 a hundred.

"That means a farmer who feeds his cattle 20 tons of grain mixture a year could save $88 by using urea. When feed prices are higher, as they are now, the savings would be even larger, while at low feed prices they would be smaller."

How about using urea in the rations of pigs and chickens?

"Don't do it—it won't work," says Hart. "Only ruminants, the four-stomached animals, get any good out of urea. That means cattle, sheep, and goats among common farm animals."

Cornell University has used urea in sheep rations, and the University of Illinois is trying it now. Cornell didn't have particularly good results, but Hart believes this was because the rations contained practically no protein. Urea cannot take the place of all the proteins, but farmers won't worry over that. Their corn and small grains contain enough protein so that urea makes a good supplement for them.

But why doesn't urea work with pigs and chickens? Or what's more to the point, why does an indigestible chemical like urea nourish cattle? For "indigestible" it is! Nature gave animals the apparatus to handle proteins, containing nitrogen, but not simple nitrogen compounds.

To explain this paradox, Wisconsin scientists evolved a theory, and by now they have gathered pretty convincing evidence that they're right.

The whole thing hinges on this fact: *Even tho animals cannot digest urea, certain bacteria can.* What happens when cattle eat urea mixtures is that bacteria in the rumen or first stomach attack the urea, digest it, multiply and grow on it. The bodies these bacteria build from urea and other feeds are choice protein—

and cattle can digest that! As the bacteria pass on through the bovine stomachs, they are assimilated.

But pigs and chickens, having only one stomach and a shorter route for feed to travel, carry on the digestive process a good deal faster than cattle; they don't give bacteria enough time to act as accommodating middlemen. What's more, their stomachs are too acid to furnish a favorable environment for the right kind of bacteria. And so it looks as though we'll have to go on feeding protein supplements such as milk, tankage, meat scraps, and soybean oil meal to pigs and chickens.

Whose idea was this, to feed cattle on a fertilizer made from air?

"German scientists thought of it first," say the Wisconsin investigators. "Europeans carried on experiments with urea feeding for a number of years, but they did not go into it far enough to prove clearly whether it works—and if so, under what conditions. Here at Wisconsin we are working with more animals over longer periods, and are looking into every angle."

It will take at least three years of large-scale feeding trials, Hart believes, to get answers to most of the questions. But meantime, urea is coming into use. It's too promising a cost-cutter to leave it alone until professors have all the answers.

9,400 Pounds Silage Corn to Acre

A yield of more than 9,400 pounds per acre of silage corn, the highest on record for the dairy research farm, was obtained last season on an experimental plot. Use of nitrogen and potash to supplement manure and standard fertilizer treatment gave this outstanding result. Supplementary treatments with nitrogen alone, or with nitrogen and superphosphate, also produced considerably higher yields than the standard treatment with manure and 0-20-20 at 130 pounds per acre.

A bad condition of firing was observed on the plot which received only manure and 0-20-20 fertilizer. Plants and roots were noticeably better when supplementary applications were made. —*New Jersey Farm and Garden*

Dried Immature Grass

Condensed from Guernsey Breeders' Journal

IN the fall of 1938 a Billingham-Type moveable tray dryer was set up at Hill Girt Farm for the purpose of dehydrating grass and clover mixtures with the idea of producing a feed of superior quality.

It is a well known fact that the highest nutritive value can be obtained only from grasses cut and preserved in an early stage of growth. By cutting these grasses when they are from ten to twelve inches in height and drying them artificially, it has been possible to conserve approximately ninety per cent of the natural carotene content of the green material. Field-curing of hay, on the other hand, causes a loss of from seventy-five per cent to eighty-five per cent of the carotene content due to the bleaching action of the sun and external moisture.

The product obtained from frequent clipping and subsequent drying is characterized by high protein, high carotene and low fiber content.

Ordinary field-cured hays may run from ten per cent to fifteen per cent protein, seldom higher, while artifically dehydrated grass often runs from fifteen per cent to twenty-eight per cent protein or higher, thus giving more protein per pound of dry material in about half the quantity of feed.

Fiber content is low due to frequent clipping of the grass and clover mixtures which does not give the crop time to build up a strong fiber content.

One of the major problems of modern farming is to control the loss of valuable top soil. A system of grassland farming enables the farmer to plant on his steeper slopes a high-producing crop for either drying in the field, or artificially, or for grass ensilage, and almost completely overcomes danger of top soil loss.

This system also greatly lessens the problem of weed control. The frequent clippings throughout the growing season do not give weeds time to mature and produce seeds. Thus within a year or two weeds are mostly eliminated.

The artificial dehydration of grass renders harvesting independent of the weather, whereas the field-curing of hay depends solely upon the weather, which during the haying season is about as unsettled as any throughout the year. Rain or shine, the artificial dehydration of grass can go on twenty-four hours a day, while in the field-curing of hay a

Reprinted by permission from the Guernsey Breeders' Journal, Peterborough, N. H., March 15, 1941

light shower can halt the entire operation. At most, only a few hours a day can be used to put in field-cured hay.

During September of 1938, forty-three acres were seeded to the following mixtures: Svalof Victoria Perennial Ryegrass, five pounds; Aberystwyth S-26 Pasture Orchard Grass, eight pounds; Kentucky Bluegrass, five pounds; Cornell No. 1777 Timothy, five pounds; Rough Stalked Meadow Grass, one pound; Ladino White Clover, two pounds; Montgomery Late Flowering Red Clover, four pounds; totaling thirty pounds per acre.

Lime requirement of the four fields was met, and an application of 400 pounds of 4-16-4 fertilizer drilled in with the seeding. Early in the spring of 1939, 400 pounds of sixteen per cent superphosphate was applied as a top dressing.

Five cuttings were made in the 1939 season, the first May 1 and the last October 6. Forty-three acres were harvested, yielding a total of 187,180 pounds, an average of 3,990 pounds of dry material per acre.

That fall and winter the fields were given a top-dressing of well rotted manure.

During the 1940 season four cuttings were made from May 9 to October 19. A total of 271,735 pounds of grass, and 408.000 pounds of grass ensilage was harvested, giving an average of 8,383 pounds of dry material per acre, an increase of 4,393 pounds per acre over the first season.

No carotene analysis was made during the 1939 season, but during the 1940 season twenty-one analyses of carotene in the dehydated grass averaged 26.58 millograms of carotene per 100 grams. Two lots of the same grass, from the same field, field-cured, averaged 9.05 millograms of carotene per 100 grams. The dehydrated grass varied from 19.8 millograms to 40.4 millograms of carotene, and the two field-cured samples contained 6.8 and 11.3 millograms per 100 grams, respectively.

Of forty analyses during the two seasons, the protein content averaged 16.50 per cent the first year and 21.08 the second. Converting this to pounds of protein: Forty-three acres yielded 29,252 pounds in 1939 and 74,601 pounds in 1940, a total of 103,853 pounds or an average of 2,415 pounds of protein per acre for the two seasons.

The application of potash and phosphate with some nitrogen may be necessary the third season in the late summer or early fall.

Fall seeding has given the best results. A compact, well-fitted, deeply plowed, and pulverized seed bed is the first essential for a good crop. Seed may be applied at the rate of thirty pounds per acre, drilled very shallow or

planted on the surface and covered over by drag chains. Deeply planted seeds do not germinate well.

Since this is fundamentally a legume mixture, the lime requirement of the soil must be met. It is advisable to use hydrated lime, disked in after the field has been plowed. An application of 400 pounds of 4-16-4 fertilizer should be made at the time of seeding. Early the following spring, preferably in March, an application of about 400 pounds of sixteen per cent superphosphate may be made.

In the fall and winter the fields should be top-dressed with a heavy application of short straw or peanut hull manure. This acts as a mulch to conserve moisture which this crop uses heavily. Fields should be rolled each spring to compact plants heaved out during the winter months by the action of frost.

In order to obtain high yields, it is important to conserve fertility of the soil by frequent use of fertilizers and manures. Once established, with proper care and management, such a mixture should last at least five years and yield big returns.

Grasses that predominate after two years are: Perennial Ryegrass ten per cent; Orchard Grass twenty per cent; Ladino Clover fifty per cent; Bluegrass ten per cent; and Timothy ten per cent. Red clover tends to disappear after the first year and at first glance the entire field appears to be a solid stand of Ladino Clover, but upon closer examination one finds the other grasses beneath the rank growth which is characteristic of this type of clover.

The following table will show what yields one could expect from such a crop during the second year. Figures are on a forty-three acre basis: Pounds of grass dried, 271,735; pounds of green grass to silo, 408,000; total pounds of dry material, 360-457; average per cent protein, 21.08; average millograms of carotene, 26.56 per 100 grams; pounds of protein, 74,601; pounds of nitrogen, 11,935; pounds of carotene, 70.61; pounds of P_2O_5, 2,066; pounds of K_2O, 8,035; pounds of CaO 3,625; average pounds of dry material per acre, 8,383; average pounds of protein per acre, 1,735; average pounds of nitrogen per acre, 298; average pounds of carotene per acre, 1.64; average pounds of P_2O_5 per acre, 48; average pounds of K_2O per acre 187; average of CaO per acre, 84.

The study of carotene losses in dried grass stored in bales, reported in Mr. Goodwin's bulletin, covered a ten months' period of storage at Foxden Farm. The grass as dried had a carotene content ranging from forty to twenty-five millograms per 100 grams. After ten months the

carotene content had, in general, dropped about one-half but was still above the carotene content of the best hay and, in general, in excess of the amount theoretically needed to maintain the health of heavy milking cows producing a calf each year.

The product seems to be very palatable. Dairy cows like it, and on tests run at Hill Girt have maintained a high degree of color in their milk throughout the winter months when fed dried grass and grass ensilage. The average color throughout November 1 to April 1 on these feeds was 7.3. Since milk color usually drops off during the winter months, it seems this product should have a definite place in the feeding of dairy cows.

Inoculate Those Legumes

Condensed from American Agriculturist

Paul Taber

ALL cultivated non-legumes must derive their nitrogen from the soil; all cultivated legumes are able to use the nitrogen of the air in their growth. This ability is of vital importance to modern agriculture.

Legumes alone cannot use the nitrogen of the air, but must be aided by bacteria so small they have to be magnified 1,000 times by a microscope to be seen. They look like tiny, round or rod-like moving forms. They enter the tiny feeder roots of the legume where they grow and multiply very rapidly, forming a little knot or nodule on the root. The more nodules on the roots, the more bacteria at work, and the more atmospheric nitrogen is being utilized.

The bacteria change the unlimited nitrogen of the air into a form which the plant can use, and the plant furnishes the bacteria with the home and food it needs. Neither can "fix" the nitrogen alone, but, working together, they can utilize large amounts of it.

Scientists, more than fifty years ago, found that the same bacteria which aided alfalfa did not work on clovers or soybeans. They found many different species of bacteria, none of which are effective on all legumes; a species could "co-operate" with only certain legumes. They also found that certain bacteria would form nodules but could not use the nitrogen from the air.

There are only four different

Reprinted by permission from the American Agriculturist, Ithaca, New York, March 15, 1941

species of bacteria needed for the important legumes in the Northeast. These plant groups which use the same species of bacteria are:

1. Alfalfa and sweet clover.
2. Medium, alsike, mammoth, wild white, and crimson clover.
3. Canada peas, vetches, sweet peas, and garden peas.
4. Soybeans.

Extensive research has been conducted at the various state colleges and experiment stations, pointing out the many advantages of inoculating legumes. They can be summarized as follows:

1. *Prevents nitrogen starvation.* Legumes are heavy nitrogen feeders. Soils generally do not contain enough nitrogen for legumes without the aid of air fixation by bacteria; consequently the plant suffers from lack of it. Crop failures of alfalfa and clover are common where the proper bacteria are not present.

2. *Increased crop yield.* The greater the need for artificial inoculation, the greater the yield increase. We hear about the big increases in crop yields. However, the smaller and more frequent increases—which often cannot be noticed by casual observance—are much more important to farmers.

3. *Improved crop quality.* The high feeding value of legumes is due to their high content of protein and nitrogen. Inoculation tends to increase both. Pea canners are interested in tender peas, and the number of fancy peas has been increased by the higher nitrogen content of the peas as a result of inoculation.

4. *Legumes enrich the soil* due to nitrogen returned to the soil. And it is in an available form. An area of alfalfa 35 miles square would, under favorable conditions, fix as much nitrogen in a season as could be manufactured at Muscle Shoals in a year. A proportionate increase is available to a farmer by an investment of about seven cents per acre for alfalfa.

The greater the proportion of the crop removed from the soil, the less nitrogen returned. Relatively little is returned by annuals like soybeans harvested for hay or grain, while perennials and biennials return relatively large amounts.

The value of inoculation on any soil depends on the number and kind of bacteria present, amount of nitrogen in the soil, the mineral (particularly lime) needs of the plant, weather conditions, and soil drainage; and varies from season to season.

While the bacteria move about rapidly, due to their size, they cannot move over two inches a day in the soil. Wind, surface run-off, implements and animals carry these bacteria from place to place. Over a span of centuries, these natural methods have given

mankind a fairly wide distribution over the face of the earth; but this does not insure the farmer, who is about to seed a field to legumes, that the particular bacteria is in his field. Therefore, it is necessary to introduce these bacteria artificially.

There are two general methods of inoculation—the soil transfer method and use of pure cultures. Until recent times, the former method was the only sure means. Soil was taken from fields where the legume has been successfully grown and spread at the rate of 400 to 500 pounds per acre, and then harrowed or disked in. This method was laborious, expensive, spread weed seeds and infection; but more important, a farmer was never sure whether he was getting enough bacteria. An adaptation of the soil method was to take four or five quarts of the soil, mix with water into a paste, and then mix this with the seed.

To overcome the disadvantages of the soil transfer method, bacteriologists began to cultivate pure cultures in the laboratory. Great progress has been made, until today many efficient inoculants are on the market. They are usually in one of three forms: liquid, jelly, or dry mixture.

A good inoculant must contain effective strains—it is not enough to form nodules. They should be the most vigorous and effective species for the particular legume group. Some strains of bacteria will form nodules without fixing nitrogen.

The amount of inoculant must be large enough to take care of the most unfavorable conditions: soil, weather, and method used. One hundred bacteria per seed have been found to be the most practical.

The inoculant must be used while it is fresh. After the period of greatest growth has been reached, the bacteria begin to die off. The length of time depends upon many factors, but bacteria probably never live longer than one year in an artificial culture. Many reach their peak in a month. The inoculant should be applied to the seed in strict accordance with the directions for the particular type of inoculant.

The findings of Professor J. K. Wilson of Cornell University lead to the conclusion that, in general, farmers should inoculate each planting of legumes.

While some fields may contain enough of the specific bacteria to thoroughly inoculate the legume, there is no way of quickly determining this fact. A field may have enough bacteria in the soil one season and none or an ineffective number the next. For sound, economical operation, the only safe practice is to inoculate every legume you plant.

When the host plant matures, most of the bacteria are absorbed by it, but many thousands are returned to the soil as the nodule

decays. If conditions are favorable, these bacteria will stay in the soil and multiply, and are ready to form nodules when the right legume is planted again. Under different conditions, they may die almost immediately. In general, they seem to live longest in soils which are best adapted to their host plant.

All bacteria are sensitive to acid soils, some groups more so than others, and will not live long under such conditions. Their sensitivity seems to be directly correlated to the sensitivity of the host plant to acidity.

Inoculated seed planted in a drill in which the seed drops through the same tube with fertilizer or comes in direct contact with fertilizer will probably result in the bacteria's being killed. Legume bacteria are also killed by direct contact with lime.

To date, there is no known method whereby a grower can successfully use inoculants on seed treated with red copper oxide or a mercury compound as these kill the bacteria. Which to use will depend on location and variety of seed and on which is the most profitable to the grower —seed treatment or inoculation.

In conclusion, inoculation is perhaps the most profitable farm operation. Inoculate each legume crop with plenty of the right bacteria. Use adapted seed. Sow on a well fitted seed bed whose fertility and acidity are suited to the legume.

Flax for Cigarettes

Use of American flax straw for cigarette paper promises to put more dollars in the pockets of farmers in the Upper Mississippi Valley. A fiber mill at LeRoy, Minnesota, which has been operating for years turning flax straw into tow for upholstered furniture and insulating material, is now working 24 hours a day to supply tow for making cigarette paper. Six Minnesota mills are now working full time to supply the demand for tow for this purpose. Herbert Miller, head of the Minnesota Resources Commission, estimates that 100,000 tons of flax straw, for which farmers get about $6 a ton, will be processed in Minnesota this year. The tow is shipped to the paper mill in North Carolina, which is also buying from California.

—*Farm Journal*

Liquid Fertilizers—Tomorrow's Plant Food?

Condensed from New Jersey Farm and Garden

Ole Lande

IS the application of fertilizer in liquid form a new economic weapon that will prove effective in the battle for lower production costs on our vegetable farms? Is it just an "accident" that such good yields have been gotten in experiments made to date? Or is liquid fertilizer perhaps the answer to the question of effecting equilibrium between applied plant nutrients and soil colloids?

Growers, scientists and fertilizer manufacturers are trying to find the answers and all seem to agree that liquid fertilizers are here to stay, though many problems are yet to be solved.

Among the farmers who are testing the new idea is Boyd Fox, of Bridgeton, N. J. The deed on his farm has been held by his family since far back in the eighteenth century, so that the Sassafras soil on his seventy-five acres has done a lot of producing through the years.

After harvesting a twenty-seven bushel crop of wheat from a twelve-acre field last year Mr. Fox turned the stubble and grew the biggest broccoli crop he has ever had — 150 eastern lettuce crates per acre. All the fertilizer applied on the field that year went on in solution, forty pounds to the acre.

This past season the field went into tomatoes, with seventy pounds of 5-8-7 commercial fertizer going on in solution at the time of transplanting. When the plants were well started they were sidedressed with 130 pounds of 12-8-8 mixture composed of seventy pounds of urea, two gallons of phosphoric acid, and fifty pounds of muriate of potash. This was put into solution in a 300-gallon tank of water, with a tankful covering about an acre. Immediately after the fertilizer had been applied the field was cultivated. Because of an anticipated saving in operating expenses, Mr. Fox proposes next season to make fertilizing and cultivating a combined operation.

As the picking season got under way last summer, cannery representatives and visitors at the farm estimated that a crop of more than ten tons of tomatoes per acre would come off the field. The Fox farm, however, happens to be in that part of Cumberland County which was hardest hit by

Reprinted by permission from New Jersey Farm and Garden, Sea Isle City, N. J., February, 1941

last summer's flood and the yield on the field was cut in half.

Mr. Fox has slashed the cost of fertilizers for the maintenance of his fifty acre bed of asparagus to a fraction of what the bill formerly totaled. From his experience, he says, "450 pounds of fertilizer applied in water will be the equivalent of a ton and a half of dry fertilizer for asparagus."

Another grower who sees in liquid fertilizers the means of effecting real savings in the cost of production is Hilyard Simpkins, of Florence, who was graduated two years ago from Rutgers University. Lying as it does near the bend of the Delaware River, Mr. Simpkins' farm is composed of a Collington sandy loam, heavier than Mr. Fox's sandy soil. A ton of lime per acre went on the Simpkins field in January, 1940, and none has been applied since.

This past season was the first in which Mr. Simpkins has tried liquid fertilizers. He mounted a 132-gallon gravity-flow tank on his cultivator. At the time his tomatoes were transplanted, on May 7, seventy pounds of 8-24-8 fertilizer per acre was watered in, and 8-24-8 went on the 19.9 acres on May 28 at the rate of 100 pounds of fertilizer in 200 gallons of water per acre.

From the tank mounted on the two-row cultivator, rubber tubes conveyed the fertilizer to valves mounted just behind the front shovel on each side of the two rows. Below these valves one-fourth inch pipe extended three inches below the soil surface, dropping the liquid in the furrow immediately behind the point of the shovel. In the first application the liquid was dropped two inches from the row. On June 11 the treatment was repeated, though the liquid this time was spaced six inches from the row. Some difficulty was encountered in the first two applications when a part of the superphosphate went out of solution and was precipitated as a residue in the bottom of the tank.

This problem was overcome in part with the third application June 18 of a 13-26-13 mixture developed by Dr. V. A. Tiedjens, of the New Jersey Experiment Station. The concentration this time was stepped up to 200 pounds of fertilizer in 200 gallons of water per acre, and was dropped twelve inches from the side of each row. Four days' time was required for each treatment of the field.

Although the rows were closed by the last week in June, Mr. Simpkins then applied 250 pounds of dry 5-10-10 fertilizer per acre, and worked it in with a one-horse cultivator in order to be sure the field had enough plant food to carry it through the long picking period.

Altogether, then, he applied

720 pounds of fertilizer per acre. His average yield from the 19.9 acres was 10.6 tons of canhouse tomatoes per acre. On his farm across the road his father, Joseph Simpkins, harvested a yield of eight tons per acre after applying approximately a ton of dry fertilizer.

In evaluating liquid fertilization, Hilyard asserted, "My plants seemed to grow more uniformly throughout the season because availability and placement were used to the fullest advantage. With this method you are dropping the plant food, in solution, right alongside the root hairs so that it is immediately available to the plant." The best concentration, he believes, is 100 pounds of fertilizer in 200 gallons of water.

In the basement of his home, Hilyard has set up a small laboratory where he runs his own tests for calcium, phosphorus, potassium, nitrate nitrogen, ammonia nitrogen, magnesium, and aluminum, and also runs tests for soil acidity. He is now assembling equipment for organic tests. Tests for all these substances are run in the fall of the year, but if he finds some plants are turning yellow during the growing season he will run a soil test. Or he may run nitrate tests of the tissues of the plants themselves. Hilyard produces soil extracts with which color comparisons are made with recognized soil standard colorations for each of the elements included in his tests.

In comparing the tests made last fall with those made a year before, Hilyard found significantly little change in the concentration of soil nutrients after the season's use of liquid fertilizer. Exactly the same tests were read for soil acidity—6.0 pH—and all elements made the same reading last fall as they did a year before. Only exception was potassium, the amount of which was increased slightly during the year.

In still another field test, and with heavier soil than was used by either Mr. Fox or Mr. Simpkins, the New Jersey Experiment Station last season grew tomatoes on a field which has been growing tomatoes year after year on the Wolpert farm near New Brunswick. Various methods of fertilizer applications were used. Identical yields — ten tons per acre — were harvested (1) where 1,500 pounds of 5-10-10 dry fertilizer was plowed under, (2) where 1,000 pounds of 5-10-10 was plowed under and 500 pounds later applied dry in a shallow furrow along the row, and (3) where fifty-four pounds of 4-16-4 fertilizer was applied in 200 gallons of water at two, five, and eight weeks after setting (a total of 162 pounds of fertilizer in solution per acre). A yield of twelve tons was made, however, where 1,500 pounds of 5-10-10

was applied dry in a shallow furrow along the row.

Reporting tests of comparative fertilizer treatments for sweet potatoes carried on during the past season at the farm of Fred H. Bateman, of Grenloch, Dr. Tiedjens said, "Results show significant increases in yield by applying much less fertilizer in solution form."

Now let's see what fertilizer manufacturers say about this new practice of applying fertilizers in solution.

F. H. Tunnell, president of F. W. Tunnell and Company, Philadelphia, asserts that "entirely new raw material sources will have to be employed in the production of strictly liquid fertilizers, and the matter of delivering liquid fertilizers in substantial tonnages presents a problem in itself. (Editor's Note: Mr. Simpkins suggests that liquid fertilizers be delivered in concentrated solution in fifty-gallon drums, with the grower diluting the solution to the desired concentration.)

"The average farmer is not likely to be willing to handle the dissolving of the product itself," Mr. Tunnell said, "particularly if the extraction is difficult to perform and if there are large insoluble residues to dispose of. The comparative cost data are not available but it would seem likely that many of the cheaper by-product sources of plant foods would be eliminated if complete water solubility became a prime requisite.

"Aside from a few specialty uses, which might include the side-dressing of truck crops which require toning up, we believe that fertilizers in the dry form will continue to command the larger market. Such fertilizers probably have the advantage of lower cost and they can and do supply plant food in a graduated scale of solubility. This does away with the necessity for repeated applications during the growing season, involving additional labor and expense on the farm."

J. R. Taylor, Jr., agronomist for the Virginia-Carolina Chemical Corporation, working in his Richmond, Va., laboratory, gave this view:

"At the present time it seems that the use of liquid fertilizers may have a place in certain areas where very intensive farming is practiced and more especially where the crops are irrigated. However, on the average farm, with the common field crops, this method of fertilization would seem to be impractical and uneconomical considering the low cost and ease of handling regular fertilizers. Much work will have to be done to determine whether liquid fertilizers can be used more economically than regular fertilizers.

"Water soluble fertilizer materials will be used in making liquid

fertilizers," Mr. Taylor said, "and if liquid fertilizers are used continuously we will probably use as many pounds of plant food as is supplied in our regular fertilizers because maximum yields cannot be made without an abundance of available plant food."

I. Preston Thomas, vice-president of I. P. Thomas & Son Company, Camden, said: "There is a definite place for liquid fertilizers in the fertilizer programs of the future. There is much research work yet to be done, but what has been done to date has convinced us that the application of fertilizer through a liquid medium, on certain crops and on certain soils, is a coming thing.

"From present indications it would seem that liquid fertilizers work to very good advantage, from a crop standpoint, on small fruits, nursery and greenhouse stock, and the general line of vegetables and greens — all on light sandy soil. We feel, however, that the continued application of liquid fertilizers in small quantities will have a tendency to deplete the soil of nutrients and result in a 'starved' soil, unless corrective measurements are taken. There will be practically no residual effect from liquid fertilizers, as compared with dry fertilizers."

In drawing up a "balance sheet" for liquid fertilizers, Mr. Thomas said: "The chief points in favor of liquid fertilizer over dry are the application of available plant food when the plant needs it, the added moisture, especially in dry seasons, and the probable reduction in costs of fertilizing per acre. Against these are the loss of residual effect, the necessity of fertilizing each crop (a practice which is not generally done when the same land is cropped two or three times per season), the leaching of a greater amount of available plant food in a wet season, and higher labor costs.

"Liquid fertilizer will require a large supply a water, satisfactory distributing machinery, and more 'brain' power than is used on some farms.

"In the belief that liquid fertilizer is a coming thing," Mr. Thomas concluded, "our laboratory has been, and is, working on various sources of plant food, as to their availability, solubility, mechanical condition, acidity, and economy—as well as running practical field experiments."

Most soils men are at a loss when they attempt to explain the results thus far shown by liquid fertilization. It has been suggested that Jackson Hester, soil technologist for the Campbell Soup Company, may have pointed out a clue during the annual meeting of the Horticultural Society in December, when he said, "You've got to get your fertilizer to establish an equilibrium with the soil

colloids if you are going to get maximum yields."

Perhaps the application of fertilizers in solution is the formula for attaining that desired equilibrium.

"GO SLOW," WARNS MR. WILLIAM H. MARTIN

The work which has been done so far at the New Jersey Experiment Station shows that under certain conditions, and with certain crops, fertilizers applied in solution have produced yields as high, or higher than, considerably larger quantities of dry fertilizer. This does not mean that vegetable growers should immediately discontinue the use of dry fertilizers in favor of the liquid form.

There are many factors at work here which need much more study. We know that the soil type, and the weather, are very important in determining the relative effectiveness of the two methods of application. We know that less labor is required to apply fertilizer dry than in solution. It may well be that further work on the placement of dry fertilizers will show how yields can be stepped up to the point where the extra cost of dry fertilizer will be no greater than the extra labor costs where solutions are used.

It is highly desirable, therefore, that the two methods be tried out on a field scale with various crops and on various soils. Growers who are willing to cooperate in tests of this nature can render a real service, as long as they understand that the work is still fundamentally experimental.

In other words, liquid fertilizers show decided promise, but it would be a serious mistake for vegetable farmers to adopt them wholesole until much more work has been done.—William H. Martin, Director, New Jersey Experiment Station

The Magic Vine

Condensed from Southern Agriculturist

Forney A. Rankin

IN 1876 the Japanese brought an exotic vine to this country to shade their exhibits at the Centennial Exposition in Philadelphia. The vine was kudzu, known in Japan as "fan-KOT." The vine grew so rapidly that within a few months its dense foliage covered the exhibit buildings, reminding visitors of the fabled beanstalk which Jack climbed to reach the home of the Giant. Its glamorous purple blossoms caught the aesthetic eye of Exposition visitors, but a generation passed before anyone discovered that kudzu had any value beyond mere beauty.

After the exposition kudzu wandered into the deep South and made itself at home. But "home" was about as far as it got, for kudzu lived an obscure and luxuriant life as ornament for porches and arbors. In time, kudzu took on the domestic name of "porch vine," though some who were more impressed by its remarkable growth called it "mile-a-minute vine."

Kudzu caught the fancy of the South, yet it was not until after the turn of the twentieth century that someone discovered, purely by chance, that livestock relished and thrived upon the tender leaves of this lush, green plant. C. F. Leach, of Monticello, Florida, became a great booster of kudzu, and as early as 1916 he was writing articles on kudzu as feed. Leach stripped kudzu of its luxurious setting as a thing of beauty and put it to work at hard labor in the fields. Other farmers, hearing of its remarkable value as feed, began to follow suit. In a few years kudzu had spread out into the Gulf States and as far north as the Carolinas and Tennessee.

On almost all kinds of land kudzu grew—on rich land or poor land, up steep rocky slopes, or down into jagged gullies. It took root every few feet, at the nodes, and spread out countless runners which covered the ground with a twisted mass of dense herbage. Wherever kudzu got a toe hold it healed the soil. It completely covered large areas — bushes, trees and even buildings — and its runners stretched out as far as 50 and 60 feet in a single season. Stock thrived and fattened on this new forage plant.

Southern farmers, experienced with honeysuckle and similar viney field pests, were afraid to

Reprinted by permission from Southern Agriculturist, Nashville, Tenn., March, 1941

let kudzu get started in their fields for fear it would smother everything in sight. Later, when they found that its feed value was equal to that of alfalfa and velvet beans, and that it could be killed out by continuous grazing, kudzu came into its own as a feed crop.

That is only half the story of kudzu. As a legume, this exotic plant possessed extraordinary power to rebuild soil fertility. Plant experts counted as many as a thousand nodules on the roots of one kudzu vine—little warehouses storing enormous amounts of nitrogen in the soil. Pecan growers around Albany, Georgia, were on the lookout for a cover crop that would improve fertility, serve as forage crop, use a minimum of moisture and not harbor pests injurious to the pecan. After years of experimentation they found that kudzu would fill the bill. Today some growers report that through the use of kudzu they have been able to reduce the cost of pecan crop production as much as 50 per cent.

A few years ago specialists of the Soil Conservation Service began looking around for a perennial plant that would anchor the good topsoil to Southern farmlands. They wanted a crop that would pay its own way, contribute some share to the farm income and rebuild the fertility of soils ravaged by erosion. The first large-scale plantings were made in the Dadeville, Alabama, erosion control area. Under the supervision of R. Y. Bailey, who for years had been experimenting with kudzu at the Alabama Experiment Station, hundreds of acres were planted in kudzu. Abandoned fields were given over to the vine, roadbanks were anchored by it, pastures were planted to kudzu, and gullies and railway fills. Kudzu was used on terraces and in meadow strips to reduce the cutting power of excess run-off.

Outstanding results with kudzu on the Dadeville area have been duplicated dozens of times in other erosion control areas and in newly-created soil conservation districts. In 1939 there were more than 40,000 acres of kudzu in the South. That acreage increased to around 82,000 acres with the planting of 50,000,000 crowns last spring. There are 5,000 acres of kudzu in the Dadeville erosion control area alone. Over half the kudzu acreage in the South is in Alabama, but the popularity of the crop is increasing every day in other states.

To see a kudzu vine at work on an old hillside or on a gully eating back into a roadway is to understand fully why kudzu is popular with the soil savers. Planted in a gully, the vines grow back and forth across the gash, creep up both sides and in a very short time, often less than two or

three years, literally choke the gully to death. Silt that washes into the gully is caught and retained by the mass of entwined vegetation. Gullies planted to kudzu have been known to fill up level with the surrounding land.

Kudzu performs some remarkable feats. Near Buena Vista, Georgia, a gully 5 feet deep and 100 feet wide in some places was threatened to eat back under a well-traveled highway. Kudzu vines, stripped from the porch of a nearby farm house, were thrown into the gulch and in a few years completely covered the gully with rope-like vegetation. Near Dadeville a farmer tried to get rid of some kudzu vines which had become a nuisance about the house. He tossed them into a gully about ten feet wide in back of his barns where they took root and eventually stabilized the gully to such an extent that a few years later he could drive his automobile across what was formerly a yawning chasm.

Suited to the South

R. Y. Bailey, now regional agronomist of the Soil Conservation Service in the Southeast, says that in the South "there is a definite need for plants that grow vigorously under unfavorable soil and moisture conditions, produce a dense ground cover that will protect the surface of the soil against the beating effects of rainfall, withstand the erosive action of large volumes of water at high velocities, restore the fertility of eroded areas by adding organic matter and nitrogen, stabilize and heal gullies, protect highway and railway banks and fills, maintain a stand of plants over a long period of years without replanting, and produce forage for livestock. It is also essential that such plants produce an abundance of planting material for use in their propagation." Then he adds: "Kudzu meets the foregoing requirements to a marked degree."

Certainly the South, with millions of bales of surplus cotton, is not interested in kudzu as a source of fabric (its fiber is so used in Japan). But this land still suffers badly from erosion, and any crop which aids in the fight against soil wastage and at the same time adds to the income of the Southern farmer will firmly imbed itself into the hearts of the Southern people.

There have been no "booster meetings" for increasing cotton production in the South for a long time. But last spring at Dadeville, Alabama, several thousand farmers, business men and political and agricultural leaders held a "Kudzu Jamboree" to celebrate the advent of kudzu to the South.

Herb Crops: Yes or No?

Condensed from Farm Journal and Farmer's Wife

IN late March the kitchen gardens behind Mount Vernon show green fuzz again. The fig and plum trees puff out their fat buds. And down across the prim beds of garden truck the first faint odors come from the rows of lavender, saffron and thyme. Day on day then, Dame Nature will push up her own tiny vials of perfume, the foxglove, the marjoram, the pennyroyal, then quickly the pungent sage, the sweet fennel and the angelica. For early Americans, from Captain John Smith's company at Jamestown to Martha Washington herself, were herb growers as well as farmers.

Druggests, manufacturers and agricultural scientists are sitting back to ponder that fact this spring. Commercial supplies of lavender, anise, caraway, coriander, mustard, sage and marjoram, all grown here before 1700, are imported today, duty-free. The old-fashioned herb garden is an oddity. Before Europe got down to earnest fighting this time U. S. manufacturers were taking $6,000,000 worth of these drugs and herbs annually from middle Europe and the Mediterranean countries.

This year, with sources cut off and in some instances stock so low that not even seed is available, they are beginning to wonder, as they wondered during the first World War, whether they can find ways to revive, but not overdo, production at home.

The Prospects

They have learned that it will take 115,000 acres of land to produce our normal imports of temperate zone drugs and herbs. They have learned that while American farmers may never compete with Europeans on a hand-labor basis, little effort has been made to develop economical machinery for deheading saffron and lavender flowers, for harvesting and threshing coriander or for digging the deep, tough roots of the licorice plant.

They are remembering, too, that many states have never had a botanical survey, that American digitalis now loses one-third of its medicinal strength during the drying process, but European strain doesn't, that the whole painstaking lore of growing, harvesting and marketing herbs and drugs was lost to American farmers somewhere between the invention of the cotton gin and the first plow furrows through the buffalo grass.

Reprinted by permission from the Farm Journal and Farmer's Wife, Philadelphia, Penna., March, 1941

In a special bulletin issued by the Federal Bureau of Plant Industry last month, A. F. Sievers, senior biochemist, points out that "stocks are probably accumulating in producing centers awaiting opportunities for export and a drop of values to below-normal levels is anticipated in some cases as soon as unrestricted trade movements are restored."

The Risks

"Producers must remember that drug and herb growing has all the quirks of floriculture and farming combined," Mr. Sievers and an associate, Dr. Frederick Crooks, told me. "Red squill is a bulb crop, licorice is a root crop, coriander is a seed crop, sage and digitalis are leaf crops, saffron and some of the others are flower crops. Some herbs are annuals and others are perennials. Some will require two or three harvestings a year; others will take two years to raise. Licorice roots can be pulled only once in three years and are said to be extremely difficult to harvest."

Both agree, however, that sage, coriander, caraway and anise offer cash possibilities. Tobacco farmers, they pointed out, will be able to use leaf sheds for drying sage and similar crops. Small grain machinery can be used to harvest anise, coriander and caraway seed if consideration is given to the ripening habits of the pods, some of which have a tendency to shatter.

S. B. Penick, president of the largest botanical drug house in the world, is generally pessimistic on the prospect of permanent home production of the crops. "We are very cautiously arranging for some of our minor crop needs to prevent our growers from taking substantial losses through ruinous overproduction," he told *Farm Journal*. "We are willing, with serious minded and thoroughly capable farm connections to work out some needed crops that will prove an advantage for them to undertake."

Yet, there are a surprising number of farm experts, druggists and scientists, who not only believe that America can grow her own herbs and drugs, but have faith in the ability of the American farmer eventually to dominate the world herb market for quality products.

More Research

This group sees progress through experimentation by state and federal laboratories, by industrial researchers and, even in small doses, by farmers. Little effort, they point out, has been made to cross-breed native and imported species of drugs and herbs. No effort has been made to probe for the molecular secrets that in the past few years have unlocked cloth from skim milk, plastics from weeds, drying oils from castor beans and newsprint from slash pine. They will argue around the clock, offering as illus-

tration the 1,000 acre planting of coriander in Russia that in 20 years has expanded to a 250,000 acre industry with seven or eight industrial and agricultural uses. They will point to the fact that Germany's present shortage of fats is met in part with seed oils. They would apply economic experimentation to home drug and herb crops and take the 1-to-2 gamble on a permanent small crop, the 1-to-10 chance of developing a million acre industrial crop.

"We believe that if the matter is properly handled and proper information is given that some little industry could be developed," wrote A. H. Brown, purchasing agent for Eli Lilly & Co., Indianapolis. . . . "Several years ago we began a little enterprise in the Northwest in an effort to induce farmers to separate the ergot from their rye grain. We have been reasonably successful and we believe that if the saving of ergot was generally practiced we could be entirely free from imports. . . . There also should be ample quantities of Juniper berries available in this country to meet its needs if people can be educated to gather them."

"Many seed spices could be grown economically in certain parts of the United States" in the opinion of A. E. Badertscher, chief entomologist of the McCormick Sales Co. of Baltimore, "and some of them could probably be grown over a wide area. We base this comment on the fact that certain spices ripen on the stalk and can be mechanically harvested. Inasmuch as the United States possesses the most up-to-date harvesting equipment in the world, farmers should certainly be able to keep the production of many of these seed spices in this country once they are started."

Pest Resistant

Clarence Meyer, of the Indiana Botanic Gardens, Hammond, Ind., is of the same general opinion and adds, "Herbs are more resistant to insect pests than most farm crops, will stand more rain or more drought than most. . . . Herb farming should become a more permanent business in the U.S.A., not just a temporary experiment during an emergency."

The Dodge & Olcott Co. of Bayonne, N. J., essential oil and perfumery processors since 1798, has already conducted some experiments on home production and is willing to purchase some of the home grown varieties for test brews of a ton. "We are glad to place at the disposal of anyone interested any data we have that might be useful," according to C. A. Myers, vice-president. "I have always felt that the problem chiefly was one of the relative cost of labor here and abroad, and whether this can be over-

come by machines is the question."

Four scientists who are out and out champions of cautious home production this year are Dr. Ivor Griffith, dean of the Philadelphia College of Pharmacy, Dr. Paul Kolachov, director of Research for Jos. E. Seagram & Sons, Louisville, Ky., Professor L. David Hiner of the Department of Pharmacy, Ohio State University, and Gorden Morrison, geneticist for the Ferry-Morse Seed Co.

A year ago Dr. Griffith proposed that the government set up a WPA project to grow medicinals and herbs. He agrees, now, that the job can be done by the farmer and joins Dr. Kolachov in four conclusions:

(a) *Funds should be set up by state and federal governments to undertake immediately botanical surveys of each state in order to examine native medicinals and determine sections where soil and climate will be favorable to herb farming.*

(b) *Farmers should plant not more than from a few rows to four or five acres of any herb crop, until actual production figures are available and economical harvesting methods have been worked out.*

(c) *Bring pressure to bear on state and federal experiment stations to develop new types of cross-breeds as well as special machinery and curing processes.*

(d) *Where possible, form producer co-operatives in order to hold down harvesting and processing costs as well as to obtain quantities large enough to make sales direct to the manufacturers.*

This month Dr. Kolachov's firm is completing plans with William H. May, commissioner of agriculture in Kentucky, for organization of a local co-operative to grow coriander seed. He predicts a yield of from 1,000 to 2,000 lbs. per acre.

Dr. Kolachov's recent booklet "Essential Oils" outlines the possibilities of American production of six herbals. It is published and sold (50c) by the National Farm Chemurgic Council, 50 West Broad Tower, Columbus, O.

So the matter stands as spring prepares to hoist the first shoots of the herbs grandfather knew so well. The manufacturers may help or hinder. The importers may cry out if asked to make an effort for U. S. Farmers. Government researchers may shrug and say that lawmakers are too, too concerned with defense problems to consider appropriations for research on a picayune 115,000 acre crop.

In Ohio, Professor Hiner will plant test crops of aromatics; along the Eastern Shore the Maryland Experiment Stations will try out mustard, coriander, caraway, sage, dill and anise. The University of New Hampshire is planting test plots of

ephedra, digitalis, pyrethrum, spearmint, peppermint, hoarhound, wormwood, catnip, chives, savory and henbane. Other test plantings will be made in the midwest and south through the National Farm Chemurgic Council.

Along fence lines and in far corners of old gardens those funny weeds will come up again. They may be just a nuisance. They may be worth money. They are at least worth research. America needs herbs and drugs. The farm needs diversified crops. 200,000 farmers growing an acre, or less, apiece would do the job.

Further Shifts in Grassland Farming?

Condensed from Better Crops With Plant Food

Ford S. Prince

Agronomist, Agricultural Experiment Station, Durham, New Hampshire

THERE is a further trend to grassland farming in the northeast region, even though more than 80 per cent of the tillage land is already in grass.

In the first place, hay pays more per hour of labor spent on it than any other dairy farm crop. Secondly, the specter of a shortage of this roughage is always in the background, and should a new seeding fail, it might create a serious, although perhaps not an insurmountable situation. Third, most dairymen have been in the habit of using their mowing lands for fall pasture, and the fewer acres of hay lands they have, the less fall feed is available. Fourth, for some years, fertilizers have been tending to a lower price level, due to synthetic processes of nitrogen production and to the discovery and development of huge potash reserves in our own country. Cheaper fertilizers make it easier to maintain yields of hay over a long period.

Of course, there is always the problem of soil erosion on the hill farms. Probably few farmers would tell you that they kept their fields in hay as long as possible to control erosion and stabilize the soil. Yet, in the background, there has doubtless been for years the knowledge that erosion, if allowed to proceed unhampered on the hill farms, cuts yields tremendously in a short time. Publicity about serious erosion is but a recent development. Still it seems probable that a

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certain knowledge of this menace has been handed down from father to son in many cases and amounts almost to an instinct in the minds of numerous farmers.

In our own State of New Hampshire, almost 90 per cent of the tillage land is in grass, and the other New England States are not far behind this figure. This is but a natural trend, for New England is a grass country. The soils, climate, and rainfall are all favorable to grass crops. (I use the term grass in its broad sense to include clovers and other biennial and perennial legumes.) Cool spring weather with ample rainfall is favorable to the grasses. Short, hot summers favor the clovers, not only yields but seed production, whereby the crop reseeds itself in old mowings under proper fertility conditions. From the standpoint of adaptation, therefore, the trend to grass has been and will continue to be sound.

The use of grass silage is now acting as a further spur to keeping more of the tillage land in grass. It is a matter of but a few years that farmers have known how to ensile the grasses and clovers and make good ensilage from them. This development alone justifies the prophecy that a further trend to grass is imminent and may, in the future, eliminate corn as a crop for the silo on many farms. It has already done this in a few instances, and since there are many very good reasons back of a change such as this, it seems likely the trend will continue.

What changes in farming practice will such a shift involve? Obviously, any shift toward a more intensive system of grassland management will require different methods of tillage and a much keener knowledge and appreciation of the part that fertilizers play in maintaining hay yields. Farm-produced manures will also have to be used differently in the farming scheme than they are at present, if the fullest benefit is to be derived from them.

If it were possible to sow a field to grass and maintain the yield for a period of years at the same level that is reached the first year or two after it is seeded down, the inclination toward a grassland farming system would be very much keener. At the moment, however, few farmers have the foresight to maintain the fertility of their soils at the proper point to achieve this goal. Still it can be done on the heavier soils, and there is ample evidence to prove it. At the Rothamsted Station in England, yields of hay have been maintained for over 80 years at the rate of more than 2½ tons per acre with suitable fertilizers. The Rhode Island Station reports an 8-year test where hay yields were maintained at 3½ tons per acre, whereas on

land not adequately fertilized, yields fell from 2½ tons the first year to little better than one ton the eighth year.

High Yields Maintained

Here in New Hampshire, we have maintained alfalfa yields very close to a 4-ton- average on land adequately fertilized with ample phosphoric acid and potash and a minimum of nitrogen, while on plots without any attention to chemicals, but with farm manure, yields averaged only a little over 2 tons per acre each year. The alfalfa killed out on the unfertilized plots, but a good stand was maintained on the heavily fertilized ones. In a number of tests with grasses in New Hampshire, yields have been maintained around a 2-ton level with chemical fertilizers alone, whereas plots not fertilized yielded only about one ton per acre.

Perhaps the most striking test we have conducted in this connection in New Hampshire is on the Livingston farm, Claremont, New Hampshire. On a field which produced corn that had been manured uniformly in 1936, we have maintained hay yields since 1937 at better than a 3-ton rate per acre, while plots not fertilized or plots from which potash was omitted have yielded at less than half this rate. Moreover, on all the plots treated with potash, clovers have persisted through the fourth season of hay, and last fall we took a second cutting from the plots treated with potash, while on the other plots, there wasn't enough hay to harvest.

Fertilizer Not So Costly

Results such as these indicate that hay yields can be held at high levels, and that plowing need not be so frequent, if farmers are willing to study their soils and the fertilizer requirements of their fields to find out how they can be adequately fertilized to maintain good hay yields.

"But," you say, "this is going to be more costly for fertilizers." And so it is. However, not so costly as it might seem at first glance, for in a grassland management system, farm manures will be used differently than at present. If the fields are not plowed so frequently, there will be more manure available for top-dressing. Since 8 or 10 tons of manure are ample for an acre in a top-dressing program, whereas farmers now use from 20 to 40 loads an acre for corn, these manures will go much further and cover a greater acreage than they do under the present system. This will cut down the need for chemical fertilizers, certainly to the extent that no farmer need be frightened over the proposition.

However, no one need think he can proceed successfully with the grassland management idea with what we now know as normal fertilizer practice. Each

acre of land will need to be fertilized annually, except perhaps for the year after seeding, to maintain yields and to hold in the stand the most desirable and high-yielding hay plants. That this is not done under present farming conditions is indicated by the rapid decline of yields, as soon as the clovers disappear.

Even if a grassland system is more costly for fertilizers, it is considerably easier on the labor bills. Plowing will not need to be so frequent, and heavy hay crops that are difficult to cure will be put into the silo. This will ease up on hay-making charges. Moreover, the labor of filling the silo will be lowered, since hay crops are easier to handle than corn. The machinery costs of the farm will also be reduced, since no corn harvester, cultivator, or planter will be necessary, if corn is eliminated entirely. In short, the whole grassland management operation can be done with ordinary haying equipment. But the greatest saving of labor appears to be in hay making, especially during adverse hay weather, when silo filling can proceed, regardless of weather conditions.

Quite aside from costs is the advantage of being able to harvest hay when this should be done. Here in New Hampshire we have definitely established the fact that early cut grass carries more protein and has greater digestibility than that harvested later, and that second crops are likewise heavier when first crops are harvested early.

In a grassland system, all the hay can be cut at the stage at which it will be most valuable for feeding. Grass crops should be cut early, before the period of bloom, clovers and alfalfa can likewise be cut at the stage when feeding value is at its height. First cuttings of necessity will often be put into the silo, not only because of the need for silage, but also for the reason that the weather in mid-June is often adverse. Hay made during this period often losses a great deal of its nutrients and vitamins as well. These can be preserved without undue loss in the silo. Under such a system, all the roughage will be of high quality, and good roughage is one of the most potent factors for success in northeastern dairy farming.

Besides these shifts in fertility maintenance and in disposing of some of the hay crops in the silo, there is one other important change in farming practice that will have to be made. This refers to the seeding of hay crops, which will often be necessary to maintain yields and to keep legumes in the hay mixtures to as great an extent as possible. Under a grassland management system, plowing may be done after the first crop of hay is cut and the seeding made in July, August, or early September as conditions

warrant. The idea of a quick summer seeding is to expose the soil to erosion as little as possible, never for a whole year, which is the case when corn is used as a rotation crop. July and August seedings are to be preferred to later ones, so that the new seedings will become well-enough established to control fall and spring erosion. Farm experience indicates that summer and early fall seedings of grasses and clovers are very successful, especially so on the heavier, well-watered soils that are most susceptible to and need protection from erosion.

Coccidiosis Can Be Controlled

Condensed from American Poultry Journal

Cliff D. Carpenter

COCCIDIOSIS never sleeps. Like many other diseases of poultry, constant vigilance is required to keep it from rearing its ugly head, even under ideal sanitation and the best of management.

Twenty-five years ago coccidiosis was a new word to the poultry industry. Once research workers thought that "bloody diarrhea" (the first name given coccidiosis), was another manifestation of pullorum disease. In 1915 the disease was recognized in a few scattered states. Little was known of the life history of the single-celled protozoan parasite, infectious in nature, which caused the disease. No one dreamed that today we would be able to distinguish, both in the field and in the laboratory, different "kinds" of coccidiosis.

Other early questions were: did chickens give coccidiosis to turkeys, and vice versa? Again, did blackbirds, sparrows, and wild birds have coccidiosis, and if so, was it the same kind or species?

Scientific work has shown that there are several kinds of coccidia —in fact, a whole family of them. Today we recognize seven members of this family, each member of which is capable of producing its own kind of coccidiosis. Fortunately, some species of coccidia do not produce seriously detrimental effects on chicks, growing pullets, or adult birds.

Turkeys have their own kind of coccidiosis, and while they may be mechanical carriers of chick coccidia, the species of these turkey parasites cannot produce coccidiosis in chickens, nor can

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the chicken varieties produce coccidiosis in turkeys. Likewise, it has been found that wild birds have their own kind of coccidiosis, not transmissible to chickens and turkeys, yet they may spread chicken or turkey coccidiosis on their feet and feathers.

The tiny parasite that causes coccidiosis cannot be seen with the naked eye. In fact, 1,000 of these placed side by side with edges touching, would occupy an area less than one inch in width. When chickens or turkeys consume but a small number of these—nothing serious happens. The facts are, a small dose of a few hundred or a few thousand actually sets up a kind of immunity or resistance against larger numbers later. Science cannot explain just how this immunity develops, but this fact constitutes one of the chief reasons why more birds do not die from coccidiosis in an affected flock.

When these tiny parasite eggs are swallowed in large numbers, they hatch out in the digestive tract and burrow into the lining of the intestine—the area depending upon the particular species. Once the intestinal tract has been invaded thus, new forms of these parasites are produced in tremendous quantities, with the result that small blood vessels of the intestinal wall are ruptured.

The most common kind of coccidiosis seen on the farm is called cecal coccidiosis, in which case the parasite attacks, primarily, the lining of the ceca or blind pouches. If large numbers have been swallowed within a short period of time, fatal bleeding will occur five days later. This explains why three or four of the finest looking birds may be found dead, with no previous warning. They bleed to death.

In the majority of the cases, however, the disease comes on more slowly, and the first warning may be noted when 10% or more of the brood become pale, appear sleepy, have rough feathers, and lose interest in eating. The disease may have been present in the flock from 5 to 10 days without an alarming mortality, simply because none of the chicks consumed a large enough number of coccidia to cause fatal bleeding.

When a chick bleeds to death from coccidiosis, it usually expells large volumes of almost pure blood for 16 to 24 hours before death. It is this characteristic which originally named the disease "bloody diarrhea." At autopsy, every tissue in the body will appear normal except that the ceca (blind pouches) are found to contain unclotted blood, or an unformed bloody mass.

When chicks appear unthrifty, as the result of a sub-fatal dose of coccidia, evidence of the disease may be found in the blind pouches at autopsy, even with

the naked eye. Seldom, however, do they disclose the same bloody mass as in the acute fatal cases. The more common picture is a cheesy mass which is composed of a mixture of mucus and dried blood. These are referred to as cecal plugs.

Other kinds of coccidiosis may appear in growing pullets, regardless of whether or not they had the cecal type between the ages of 3 and 8 weeks. Often on range, but more frequently if the pullets are confined, one may experience the loss of several pullets and find that the upper part of the small intestine (duodenum) contains large masses of blood. In these cases the intestine often appears ballooned, the walls very thin, and close examination, without opening the intestine, may reveal small white points about the size of a pinhead.

Originally called chronic coccidiosis, it can be seen at once that the intestinal form may be just as acute as the cecal. This intestinal form, as suggested above, is brought on as a result of pullets consuming large numbers of an entirely different species of coccidia.

Some species of coccidia may attack other parts of the small intestine, leaving as the only evidence of the disease an unthrifty pullet; at autopsy, certain areas of the intestine may be thickened, and small inflamed areas may be noted. But a laboratory examination is required to identify positively, the cause.

Diet and Sanitation Important

Coccidiosis in all its forms is best controlled by brooding chicks and rearing pullets in a clean environment, and encouraging feed consumption during an attack. The sanitation program includes a clean house plus a reasonably clean and dry litter. If the brooder house is movable, the chicks should be brooded on ground where no poultry has been raised for the two preceding years. Otherwise the ground may contain live, though dormant, forms of the parasite. If the house is not movable, alternate yards should be provided from year to year.

Likewise pullets should run on clean ranges—not using the same range year after year without rotation. Nor should poultry droppings be used as a fertilizer where chickens are to be raised.

In whatever form the disease appears, regardless of age, some form of milk should be used at once. The milk in itself is not a specific, and the early belief that coccidiosis could be avoided by feeding large quantities of milk has been exploded long since. If, however, milk is used judiciously, it serves as an appetizer and is the finest type of nursing food to help the chicks weather an attack.

The lactose (milk sugar), because of its sweetness, appeals

to the chicks' sense of taste, and encourages adequate food consumption. It can be said in this connection that, with the average attack of coccidiosis, more birds starve to death than bleed to death. Since the disease runs its normal course in a few days, it can be seen that if the birds keep eating, the percentage of recovery will be high in all except those which consumed large, fatal numbers of coccidia. Since dried cheese whey is richer in milk sugars than any other form of milk, many poultrymen have found this product to be a most valuable one in controlling this disease.

Dried skim milk, dried buttermilk, condensed buttermilk, and condensed whey have been used by poultrymen with good results. It is important that high protein milk mashes not be used excessively. The high level of protein stimulates growth artificially, and seriously damages the kidneys.

Many poultrymen use a high milk content mash for one day when the disease is first noted, and then clean the brooder house thoroughly the next day, and renew the litter. In such cases the milk mash may be used on alternate days for decreasing lengths of time, until the birds are through the attack.

Coccidiosis Tomorrow

Recent experimentation has shown that several forms of sulphur, sulphur flour, and colloidal sulphur, are quite specific in preventing cecal coccidiosis. A form of rickets, however, may accompany the use of too much sulphur, but there is evidence that some of these products may prove to be of considerable assistance in the near future. More research and large numbers of trials under practical conditions are needed before a broad recommendation can be made for the use of sulphur in preventing coccidiosis.

The successful poultryman has learned to live with coccidiosis, and while this disease may always be with us, it can be predicted that losses will become less each year, as we better realize that light attacks confer resistance against later fatal attacks; that the disease runs a limited course, regardless of methods used to treat an outbreak; and that losses depend upon the numbers of coccidia consumed by each bird, and the total amount of proper food eaten during the attack.

High Producing Hens Pay Best

Condensed from The Southern Planter

DATA collected during the six years of the Maryland Egg Laying Contest show that the production of one egg requires about one-eighth pound of feed in addition to the feed required to maintain the body weight, activity and body functions of the hen. The maintenance cost for hens of the general-purpose breeds, which averaged 5.7 pounds in weight, was about 68 pounds of feed per year; and for Single Comb White Leghorns, which averaged 3.6 pounds in weight, about 56 pounds per year.

Since the eggs produced must pay for the feed eaten, including that used for maintenance, the feed cost of egg production for low producers is much greater than that for high producers. As egg production per hen goes up, feed cost of producing a dozen eggs goes down, as shown in the following table:

Annual production per hen	Pounds of feed required to produce a dozen eggs
250-egg hen	4.2
200-egg hen	5.0
150-egg hen	6.0
100-egg hen	8.3
50-egg hen	15.0

In Maryland during 1938, a Leghorn hen producing 91 eggs just about paid her way, with nothing left for her owner's labor; while a Barred Plymouth Rock, New Hampshire or Rhode Island Red hen had to lay about 100 eggs to pay for her keep. Each Leghorn hen that laid 180 eggs and each general-purpose breed hen that laid 200 eggs returned about $1.50 for the owner's trouble.

A New Farm Movement Takes Rapid Root

Condensed from Soil Conservation

Hugh H. Bennett

Chief, Soil Conservation Service

THE soil conservation districts movement is sweeping this country in a manner unprecedented in our agricultural history. There has been no movement comparable in speed, scope, or significance to the spread of soil conservation districts formed by landowners themselves for the defense of their own lands through their own leadership and direction.

Yon can now travel from the Potomac River in northern Virginia to the lower Mississippi and be in a soil conservation district all the way; and you can make such a trip by either of two widely separated routes. More than that, you can travel from the Potomac to San Antonio, Tex., and never be outside of a legally organized soil conservation district except for a short gap along the Mississippi River.

And it has been only 40 months since the first soil conservation district law went into the statute books of Arkansas. The Arkansas law was passed March 3, 1937; but before it became effective on July 1, North Carolina passed an act and chartered the Brown Creek District—the first to be formed in the country.

That was how it started.

By December 26, 1940, 38 States had adopted soil conservation district legislation. On that date 435 soil conservation districts had been organized, involving a total area of about 271,000,000 acres. Approximately 1,600,000 farm families, or about one-fourth of all the farm families in the United States, now live within soil conservation districts. At the present rate of formation, more than 600 districts will have been established by 1942, comprising more than 400,000,000 acres of land.

The movement has extended to most sections of the country, but it has marched ahead most rapidly in the South where the problems of soil conservation are most acute. In the Southeast—Virginia, the Carolinas, Georgia, Alabama, Mississippi, and Florida—districts have been added to and

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new ones established at the average rate of 92,000 acres per day. From January 1 to July 1, 1940, they grew at the average rate of 145,000 acres a day.

Movements of this kind are neither incidental nor accidental in the progress of human affairs. They do not happen without some powerful stimulus or catalytic process.

We know what the stimulus was. It was the soil conservation demonstration program, plus an educational effort that woke millions of Americans to the problem of erosion. Dust storms, the results of research at the erosion experiment stations, the 1935 survey of erosion in the United States, the educational program carried on by the Department of Agriculture, the work of the A. A. A.—these all helped.

But more than anything else, it was the work done with farmers in the demonstration program that led to the idea of soil conservation districts and set the pattern for this new kind of governmental action.

Early in 1934, the first soil conservation demonstrations were set up in various representative localities throughout the country where erosion was known to be a serious problem. Preparations had been started in September, 1933, by the newly created Soil Erosion Service, and projects were actually under way months before the first great dust storm of May 12, 1934. By the end of 1937, when emphasis shifted to the districts, there were 504 of these demonstration areas including the work areas of the 339 C. C. C. camps working under the supervision of the Soil Conservation Service, covering nearly 12,000,000 acres in 45 States.

These demonstrations showed how practical farm measures, fitted to the needs of the land, will stop or retard the depredations of soil erosion and the unnecessary waste of rainfall. Most of the areas took in the whole drainage basin of one or more typical streams—all the land extending back from the stream banks across fields, pastures, and woodlands, to the upper limits of the smallest streams, and to the top of the enclosing uplands.

On the farms within these areas, control work was carried on in close co-operation with those farmers who could see their way to enter wholeheartedly into a complete program under which every acre of their land would be treated in the most effective way from the standpoint of saving soil and maintaining or increasing income.

The results generally were successful to a considerable degree, in numerous instances to a very high degree. Some measures failed to do the job they were intended to do. Those were discarded immediately and others

were tried—better measures frequently were indicated by those that had failed.

Not only was erosion reduced or completely controlled, but flood heights were markedly reduced along many small streams, and some streams that had been running red or yellow or brown with flood flows charged with rich topsoil were reduced in turbidity or almost cleared up.

The success of these demonstrations was immediate. As interest in them grew, farmers began to demand more and more assistance in controlling erosion, conserving water, developing wildlife, draining wet lands, controlling floods. Every day since the results began to show, 6½ years ago, the demand for more assistance in soil conservation and related work on the land has increased. It has poured in on the Soil Conservation Service and other agencies, both Federal and State. It keeps on coming, from the people who live on the land.

It was this farmer demand, usually strengthened by the voice of the entire community—the townspeople as well as the farmer—that led to the development of the soil conservation district movement. The experience gained through the soil conservation demonstration projects pointed to the need for increased community action in soil and water conservation, for greater assistance and wholehearted participation on the part of all the people affected by the impoverishment and ruin of productive soil. The results of the demonstration work showed also that we had reached the point where the main job was not merely to show what could be done, but to spread as rapidly as possible those measures of conservation that would give security to the agricultural land of the Nation.

This was a work task of immense proportions, involving the protection of hundreds of millions of acres of farm land, grazing land, forest land, and land for the sustenance of wildlife. Surveys showed that of the 462 million acres, approximately, of *good farm land* remaining in the country (including that currently in use and that which could be brought into use through irrigation and drainage operations), all but about 130 million acres was subject to erosion wherever used without adequate measures of protection. Good land was washing or blowing away at the rate of more than 500,000 acres every year, with a vastly greater area undergoing continuing impoverishment.

Abuse of land goes beyond the field, beyond the farmer. It touches the entire community, the whole Nation. Waste the farmer's capital of productive soil, and you squander the support of villages, towns, and cities. Migrant farmers, underfed

Americans, choked streams and floods mounting to higher crests; reservoirs ruined by the products of erosion, drainage canals and ditches filled, highways, railways, and bridges washed out or undermined, bleak gullies and sterile subsoil for vanishing wildlife—these and other symptoms of national decline are results of erosion that reach beyond the fence lines of fields.

To cope on a broad scale with this problem of a vanishing land resource and all its allied evils, the soil conservation district was designed and proposed.

What Are Soil Conservation Districts?

Soil conservation districts are farmer-formed and farmer-run, for farmers. They are established only upon the petition of landowners and then not until the will of the majority has been expressed in a referendum. The districts are controlled and operated by a board of five supervisors, three of whom are elected by the farmers. Every landowner has a voice in shaping the policies of the district in which he lives. The vote of the one-horse farmer is just as strong as that of the large-scale operator. The aims of the district, its land-use policies, and the soil and moisture conservation measures it recommends, are set forth in a work plan, which is drawn up by the local supervisors and approved or disapproved by the landowners.

The districts are legally constituted units of local government set up under a State law. They are a new kind of government organization. They owe no allegiance to any State or Federal bureau or agency, or to any local organization. They have no taxing power. The operating procedure represents democracy at its best. Not a step is taken, not a plan is made, not an erosion-control measure is placed upon the land that does not first have the concurrence of a majority of the landowners affected.

In carrying out the work of conservation within a district, the farmer-controlled board of supervisors may call upon local, State, and Federal agencies for such assistance—technical and otherwise—as the agency may be in a position to provide. At present the Department of Agriculture is co-operating with 294 soil conservation districts throughout the country.

In many of the districts now operating, business, professional, and agricultural interests have allied themselves in a manner seldom duplicated in any other type of community activity. The districts are not merely erosion-control agencies. They may, by law, perform any function which contributes to the "conservation of soil and soil resources"—and that just about runs the whole scale of land-use operations.

For example, one southern dis-

trict operates a nursery where seedlings are produced for planting on co-operators' farms. Labor for these nurseries is provided by local farm clubs and community organizations in a way that resembles the old log rollings, house raisings, and quilting parties of pioneer days. Districts in some localities are operating marl pits for the production of marl for improving pastures and fields. Some districts are providing machinery for crushing limestone, while the C. C. C. and W. P. A. provide labor. Many districts deal with flood-control problems, and several have established fire-protection associations.

The Winooski Soil Conservation District in Vermont is concerned largely with streambank erosion control. The San Mateo District of California is attempting to improve irrigation practices as part of its program. The Cedar District in North Dakota is leasing certain county and State school grazing lands, then subleasing on a restricted grazing basis in order to improve the range. The Leake District in Mississippi is attempting to drain the more level lands so as to be able to retire to trees the steeper slopes now being farmed. The control of floods, the purchase and retirement of submarginal lands from the hopeless kind of farming that perpetrates relief problems, adjustment in the size of farm and ranch units, more equitable methods of taxing the land, the development of water facilities such as stock-watering ponds and wells, farm forestry, improvement of land-tenure conditions, and numerous other undertakings are among the objectives of many of the soil conservation districts across the country. Practically all districts are attempting to bring about the best possible use of each acre of land and at the same time to conserve and rebuild it so that the men, women, and children on the land may live decently, securely, and happily.

There is in the district probably the most potent stimulus to maintenance of conservation habits and conservation works—in short, the best possible instrument ever devised for the *establishment of permanent agriculture through the building of a conservation culture.*

A sound district program and work plan are the first essentials in a successful district enterprise. Success in any soil and water conservation work will depend, always, upon clear understanding of the landscape—not just what farmers know, but on this plus what the land technician, the erosion scientist, the plant specialist and other technicians know individually and collectively. And not only that—it is necessary to have also the collective application of this technical and practical knowledge, fitted to the land ac-

cording to the adaptability of the different kinds of land and the individual needs of every acre of land in every field, woodlot, pasture, of every gully and every flooding streamlet. Furthermore, one measure should be used to support another, and what is done in one field should be done, wherever possible, so as to benefit an adjacent field or gully or some piece of land somewhere downstream.

Sound district achievement, like most other types of enterprises, requires a force that has sufficient technical skill to meet whatever problems arise within the enterprise. At the present stage of development, soil conservation districts are necessarily relying largely on public agencies, particularly the Soil Conservation Service for this skilled technical help. The districts should look forward, from the very beginning, to the day when farmers and ranchers themselves will have acquired more of the skills which they may now lack, but which are necessary to carry out the district program—skills that will become conservation habits.

Recently much has been said about decentralization of the work of agricultural agencies and the turning over of agricultural programs to county, State, and other organizations.

Through the soil conservation district, the Soil Conservation Service has decentralized its activities to the ultimate degree. Its operations are guided by farmers themselves, through the functioning of democratic processes at the grass-root level. It may be said that through this approach, the responsibilities of soil and water conservation work is actually in the hands of farmers themselves. And the work of conservation is going ahead in this way very well.

In fact rather than in theory, the Soil Conservation Service has decentralized its major activity in a way that farmers understand and approve every day through local community action on thousands of farms throughout the country.

A Case of Posthumous Breeding

Condensed from Holstein-Friesian World

Howard Clapp of Pabst Farms

THREE black and white calves at Pabst Farms kick up their heels and race around in their box stalls entirely unconscious of the close margin and the unusual circumstances by which they exist at all. They are two bull calves and a heifer calf that were born in September as a result of posthumous breeding, probably the first trio of such origin ever born. The dams of these calves were bred and conceived with semen taken from a sire killed the previous day. The chain of life continued unbroken even after his death, thanks to experience with artificial breeding methods.

In the fall of 1938 at the Walters Dispersal Sale Sir Bess Ormsby Fobes 73rd was offered for sale under exceptional conditions. In March of 1938 he had received a hind leg injury, becoming "stifled," and was unable to serve a cow. Attempts to use him artificially by the massage method had not succeeded. He was offered for sale without bringing him to the sale barn due to his crippled condition. Announcement of his status was made and, with the thought that he might be desired by a breeding institution that might like to try him artificially, he went under Gene Mack's hammer with the understanding that the purchase price would be held in escrow by the sale management until calves from him were secured.

A bid of $150.00 by Mr. Fred Pabst secured him for Pabst Farms, Oconomowoc, Wis. The good type of his daughters and his high index of 768 lbs. of fat in Class B with a test of 4.25% were factors that made his use desirable, if at all possible. by any means. His development in the Henry Wegener herd and the Walters herd as one of the breed's leading proven sires reflected his good ancestry. His daughters in the sale brought as high as $2000.00 and his twenty-three offspring of all ages and both sexes averaged $581.00.

We felt quite fortunate when he survived the truck trip from Waterloo, Ia., to his new home at Oconomowoc.

Many additions to and changes in his diet were made in order to secure the production of good semen. Green hay, carrots, cod liver oil, sprouted oats, blood meal and skim milk powder were given him as well as wheat germ

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oil. Hormone injections were also tried. Green feed was brought to him during the growing season.

Attempts to use him artificially occasionally by the massage method were not successful. Live sperm cells with excellent motility were found in many samples secured but at no time was a really normal sample taken. This was in contrast to our experience over a four year period with over fifteen other bulls by the massage method in which cases nothing prevented the successful collection of good semen. With the best samples we were able to secure from 73rd we bred fifteen cows with no conceptions resulting.

As his condition gradually grew worse we realized that our experiment with this crippled twelve year old bull could not succeed.

In the fall of 1939 we decided to put him out of the way, to collect semen from him after his death, and to breed as many cows as possible to him. Many of our cows and heifers were left open with the hope that we might get many of them in heat during a single week following the death of 73rd.

Knowing the week when the most animals would be available to breed, a date to destroy him was set and plans laid to carry out this breeding.

The date originally selected to destroy 73rd came the same week as the Waukesha sale and, due to our consignment there and the visitors and extra work involved during sale week, the event was postponed for three weeks to prevent interference with our plans.

Almost three weeks later upon the writer's return from the International Live Stock Exposition on December 4th he found 73rd had become so bad on his other hind leg that he had not been able to get up for two days although resting easily and feeling good otherwise.

The next morning the deer hunter of our crew was called upon to bring his rifle and send him to greener pastures. We had become fond of the old fellow and each of our crew had a feeling of affection for him that had to give way to the technical needs of the moment. The writer had made the mating that produced his dam in the Hollyhock Farm herd, had made the mating that produced him and was present at his birth and had followed his career with an affectionate interest.

His reproductive tract was removed and semen taken from the enlargements of the ampullae, from the ampullae themselves and from the epidydimi, the semen from each part being kept separate. Egg yolk buffer solution was mixed with these samples and the Russian dilutor SGC2 was used in a case or two. All samples showed excellent motility when examined under the microscope, both those di-

luted and undiluted, and were of normal density. All samples were stored in test tubes in a refrigerator at 48 degrees Fahrenheit.

The results of the use of this semen were disappointing in that many cows were bred and only three conceived. These three made the attempt worth while, however, and in any such attempt the experience gained is valuable for future use.

On the day of 73rd's death four cows were bred with the semen saved. Four more were bred the next day and more on following days through the fifth day after his death. On the fifth day following his death, or at the end of 120 hours, the motility of the remaining semen was very good. On the seventh day all sperm cells were dead.

Seventeen animals in all, that were considered normal, were bred to this posthumous semen. In each case the animal was inseminated with semen from one part of 73rd's reproduction tract only. For the benefit of the technically minded it is of interest that only animals bred with semen from the epidydimus conceived and only three out of eight of these. These were three out of four that were bred 24 hours after his death. None bred with semen taken from the ampullae or their enlargements conceived.

It seems to the writer that results might have been far different if 73rd had been a vigorous, normally healthy animal at the time of his death. It is well known that exercise has a favorable effect on the breeding efficiency of a herd sire and he had been unable to even walk around well for a year and nine months previous to his death.

In the case of really valuable proven sires this breeding method seems a worth while procedure to secure more of their offspring. As was this example, there is an occasional crippled sire for which this is the only possible method.

Often the hands of Death grasp success away from a breeder's attempt to perpetuate his choice animals and families. In this instance those hands actually clutched success in their own greedy fingers and then had it snatched away from them and conceded this trio by Sir Bess Ormsby Fobes 73rd to the Pabst Farms herd.

The calves eat and grow, show the same enthusiasm for their warm skim milk and kick up their heels with as much spirit as do their comrades. Lying in the straw and chewing their small cuds with blissful satisfaction, they view the world with bright shining eyes,—the eyes of normal calfhood but eyes that show no concern over their origin.

Red Fescue — A Specialty Crop

Condensed from Pennsylvania Farmer

H. B. Musser

ANY farmer who is interested in growing commercial seed crops should not fail to investigate the possibilities of seed production of the forage and turf grasses which at present are almost entirely imported from foreign sources. In particular he should not miss examining into the merits of red fescue.

This grass is used primarily for fine turf purposes. It is the base of most shady lawn mixtures and frequently is used also in general seed mixtures for turf in parks, athletic fields, golf courses and airports. Its toughness and wear resisting qualities make it particularly desirable for such purposes and have given it a very definite place in fine turf culture.

Over the last ten-year period the average yearly importation of red fescue seed has been almost one and one-quarter million pounds. Some of this has come from Europe but, year in and year out, the greater part of it has been purchased from New Zealand. If this had been grown at home as a specialty crop it would have materialy increased the income from the more than four thousand acres needed to produce it.

Consumption of red fescue seed has always been too low. Too often it has not been used for fine turf where it could and should have been seeded. And even when it has been a part of seed mixture the percentage used often has been way below the figure that would give best results. Factors chiefly responsible for this situation have been price and seed quality.

Seed prices almost always have been high. United States Department of Agriculture figures show that over the last five-year period the average wholesale price has been forty-four cents per pound. In 1935 prices went up to better than fifty-five cents per pound, while the minimum for the period was thirty-two cents in 1937. During this same period wholesale prices of Kentucky bluegrass averaged well below twenty-cents per pounds. Kentucky bluegrass and red fescue are both used as base grasses in seed mixtures for fine turf production and, to some degree at least, may replace each other.

It is only common sense to expect that a wide differential in price will operate to reduce the use of red fescue whenever it is

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possible to substitute Kentucky bluegrass for it.

The fact that so much fescue has been used, in spite of the price, is a direct indication of the definite place it occupies in fine turf production. It is quite conceivable that if prices were reduced consumption might increase to at least four or five times the present rate.

The other important factor that has limited the use of red fescue has been the uncertain quality of the seed,—principally low germination. This condition is due primarily to the fact that this species of grass ripens its seed while the stem is still quite green and sappy, and means that harvested seed may have a moisture content too high for safe handling. If it is not cured carefully it will heat rather easily in storage or in transit. Of course, any appreciable amount of heating will injure germination severely. When it is remembered that seed coming to the United States from New Zealand must take a long ocean trip through equatorial waters it can be readily understood why germination may be seriously affected. High temperatures develop in holds of vessels and if there is even a slight excess of moisture in the seed heating and fermentation will begin.

Importers and shippers have recognized this danger and have overcome it partially during the last few years by shipping in refrigerated holds. This has added to seed costs. And, although it has definitely reduced injury in transit, it has not eliminated the danger of subsequent deterioration of the seed after it gets into the storage bin of the American distributor. All too often importers have had the experience of finding that seed arriving during the summer with a germination of between 80 and 90 per cent has dropped to 60 per cent or even less by the following spring. Experience with a few lots of seeds like this very materially lessens the enthusiasm of the consumer for red fescue.

Oregon farmers have begun to recognize the possibilities of red fescue seed production and in 1939 the state claimed a total production of 300,000 pounds. H. A. Schoth, agronomist of the United States Department of Africulture, writing on seed production of turf grasses on the Pacific Coast, in the April, 1939, issue of Turf Culture, states that "Yields vary from 50 to 600 pounds per acre with an average of about 150 pounds." In tests at the Pennsylvania Experiment Station at State College, Pennsylvania, seed yields over the last five-year period have averaged just above 400 pounds per acre on soils of average fertility. On the basis of these results from such widely separated sources, it would seem that there

should be no question of the ability to get satisfactory yields in the United States.

Ability to compete with imported seed also bases very directly upon the domestic costs of production. Production costs are pretty elusive things to corral, depending as they do on so many different factors, such as land rentals, taxes, labor and all the items of seed, fertilizer, planting, harvesting and marketing a crop. They are inextricably tied up with such intangibles as individual initiative and the "breaks" of the weather. So average figures are practically worthless. However, any one may make a fairly good approximation by applying his own figures to the items involved in the process of production, and can arrive at a reasonably sound estimate if he knows something of the habits and characteristics of red fescue and the details incident to producing a seed crop.

First, then, this grass is a happy-go-lucky sort of plant. It is not choicy about its living quarters and will get along well under a wide range of soil and climatic conditions. It not only will survive but will produce a fair crop at soil acidity levels which generally would be fatal to grasses like Kentucky bluegrass and timothy. Also tests at the Pennsylvania Experiment Station show that it is much more tolerant of low fertility levels than many grasses, and can go a long time without a drink of water. None of this means that good soil, good feeding and good moisture conditions will not pay dividends. It simply serves to show that red fescue is not so delicately adjusted to its environment that it needs particular babying or special nursing to be induced to produce a crop.

One qualification of this statement must be made. Red fescue does not like high temperatures coupled with high humidity. High temperatures alone are not serious, but when they are combined with excess moisture trouble results. Injury to the grass under such conditions usually is associated with the development of fungous diseases. From a practical standpoint this suggests that growing red fescue for seed production should be confined to the more northern latitudes or higher elevations.

Because the grass has so few eccentricities there is no particular difficulty in establishing a stand. Maintenance costs will be materially lowered if clean land is chosen for seedlings, or if some attention is given to cleaning up a field before a planting is made. The latter is really a rather simple procedure of summer fallowing with an occasional harrowing to kill germinating weeds in preparation for early fall seeding. On reasonably clean land seedings can be made in the

spring or early summer without this preliminary clean up.

Apparently, the best method of seeding is in cultivated rows. Practical experience in Oregon and experimental results in Pennsylvania both indicate that, although row planting costs are higher than for broadcast seedings, these are more than made up in better yields of higher quality seed. During five years of testing at the Pennsylvania Experiment Station row plantings have consistently produced good yields of high quality seed. In contrast, yields from broadcast seedings have been much more erratic. This is no doubt due to the fact that in drouthy seasons the effects of competition for available moisture are much more serious when individual plants crowd each other in a solid stand than where they have elbow room in cultivated rows. It is quite probable that differences in the effect of competition for available plant nutrients may be a factor also.

In estimating costs of production the items of seed and fertilizer also must be taken into account. Neither of these adds very materially to the expense of producing a crop. Tests have demonstrated that ten to fifteen pounds of seed per acre is sufficient for row plantings. Even on the basis of excessively high prices, which prevail at present, seed costs become relatively insignificant when distributed over the five to ten-year productive period of a planting.

No very satisfactory information is available on fertilization of red fescue for seed production.

After a seeding has been established, its life—that is, the number of seasons in which a satisfactory crop can be harvested from it, will depend largely on the care that is taken of it. If a thorough clean-up of weeds has been made prior to seeding, subsequent care is simple indeed. Two or three cultivations per season with perhaps a little hand work to clean out weeds from the edges of rows is about all that is necessary. This, of course, is in addition to a light side dressing once each season with a good complete fertilizer. Both of these operations are simple and require only ordinary equipment. Under normal conditions, they should not increase production costs seriously enough to threaten good net returns.

Various methods of harvesting have been used. In Oregon, most of the harvesting is done directly with a combine although some growers swath the grass first and use a pick-up attachment. Some harvesting, also, is done with a binder using special attachments for catching shattered seed. It is probable that harvesting directly with the combine is the simplest and most satisfactory method of handling the crop

even though special care sometimes must be used to keep the crop in condition.

Because of the high moisture content of combined seed, it may be necessary to use some method of quick drying to prevent heating and fermentation. A common practice is to spread the seed in a thin layer on the barn floor and turn it with a shovel at least once a day for a week to ten days. This may or may not be a major item of production expense, depending upon the condition of the seed when harvested.

The only additional treatment of the seed before it is ready to market is a quite simple cleaning operation. Simple at least, if the planting has been kept clean! The trouble and expense of cleaning the seed will depend upon the type of impurities in it. A very good quality of rough cleaned seed can be secured from reasonably clean plantings with the ordinary type of farm fanning mill.

On the basis of average seed prices over the last five years, there would be little question of a good return to the producer. It is open to argument, however, whether it is possible or even desirable to maintain such prices. The practical difficulty of maintaining high price levels as domestic seed production increases is obvious. On the other hand, the relative ease of producing good yields at moderate cost would seem to indicate that very appreciable reductions in prices could be made without getting on the wrong side of the balance sheet. The increased use at lower cost levels should compensate, over the long pull, for reduced returns on a single crop.

What can be done with fescue is typical of the possibilities of a number of grasses that have a definite place both for fine turf and pasture in this country. The new strains of timothy and rye grass as well as new Kentucky bluegrass, orchard and many legume selections, all present opportunities for profitable seed production. If a reasonable degree of common sense is used in concentrating the growing of a certain type to an area restricted enough to make possible economic handling and distribution, there seems little doubt but that they are worth giving a trial.

The Papaya in Florida

Condensed from American Fruit Grower

S. J. Lynch

Florida Subtropical Experiment Station

NO other tropical fruit appearing on the markets of the United States during the past two decades holds more promise of becoming a commercial crop in South Florida than the papaya. It is fast gaining prominence among the fine-flavored and health-giving fruits of the tropics. This is brought about in part by the increased appearance of the melon-like fruit on the markets and the food and drink products manufactured from the fruit pulp. Information concerning its history, qualities, culture and future possibilities are eagerly being sought by the public.

The papaya (Carica papaya L.) is native to tropical America, probably in the vicinity of Mexico. Due, no doubt, to the considerable length of time its seed remains viable, and to the ease with which it is propagated by means of seed, the papaya was rapidly disseminated through the humid tropics of the Eastern Hemisphere once the discovery of the American continents brought it to the attention of explorers. It has always been a common fruit in the diet of its native home, and soon became highly esteemed among the cultivated fruits of such lands as Hawaii, Ceylon, India and other tropical islands of the Pacific. In a goodly portion of the tropics, the finer flavored types of papaya began replacing the cantaloupe and melon so important in the diet of civilized man.

In the United States, and in Florida particularly, the papaya has been grown for its fruit by a considerable number of people for about 50 years. But it is during the last two decades that it has been grown with the thought of sale to the public, and grown in quantities large enough to warrant the establishment of market demand.

The papaya plant is very susceptible to cold injury. In the United States, it can be grown safely in extreme South Florida and in some of the more protected locations in Central Florida. In these areas, the farmers are taking a decided interest in papaya culture. A considerable

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acreage is being planted, and plans are under way for additional plantings.

The papaya is a giant herbaceous plant, with usually a single branchless tapering trunk varying in heights from three to twenty feet, bearing at its top large, deeply lobed leaves sometimes two feet across upon hollow petioles two feet or more in length. "Palm-like" is a common description of its general appearance. The roundish to cylindrical melon-like fruits are borne on short stems in the axils of the leaves. The fruits vary in size from a few ounces in weight, with a thin flesh and a comparatively large central cavity, to 25 pounds in weight, with a flesh from one and one-half to two and one-half inches thick and a relatively small cavity. The texture of the flesh is similar to that of a cantaloupe, yellow to reddish orange in color, with a sweet musky flavor. The small numerous black seeds are borne on a thin membrane attached to the inner surface of the flesh. The very thin green cuticle or skin changes to a greenish yellow or orange color when ripe.

The papaya appears both in dioecious form (staminate and pistillate flowers on different plants) and in the monoecious form (both sexes in the same flower). This unstableness of sex causes difficulty in producing successive crops of similar type fruit. Breeding work tending toward the establishment of uniform strains is being carried on at the Subtropical Experiment Station.

A study of the constituents of the papaya flesh shows that, like most other fruits, its chief component is water. According to Stahl's analyses of several Florida-grown papayas, the components, given as percentages by weight of the fresh pulp, are as follows: moisture 90 to 92 per cent; acid 0.1 to 0.2 of one per cent; protein 0.2 to 0.3 of one per cent; ash, which is an indication of its mineral content, 0.25 to 0.5 of one per cent; and sugars five to six per cent. The abundant sugar content of the papaya is almost entirely simple fruit sugar. Starch is entirely absent in both green and ripe fruit.

Several vitamins are abundant in the papaya fruit grown in Florida. Fresh pulp, according to Abbott, is a good source of vitamin A, contains vitamin B and is an excellent source of vitamin C. The papaya is considered one of the richest sources of vitamin A among the fruits grown in Hawaii.

An enzyme called "papain" is present in the juice of the papaya fruit and also in the sap of the vegetative parts of the plant. This proteolytic enzyme is a digestant similar in action to the pepsin in the stomachs of higher animals and to tryspin, present in the pancreatic juice of animals.

Many of the digestive aids found on the market contain papain, as do many chewing gums and meat tenderizers. A common practice in the tropics, among the natives, is to rub a piece of tough meat with the juicy flesh of a green papaya fruit some little time before the meat is to be cooked.

The papain content of the fruit is thought to decrease considerably as ripening progresses. However, the presence of papain, the rich vitamin content, the absence of starch, the high fruit sugar content and its sweet musky tang, have made the papaya ideal for use as a fresh fruit and have given the cue to the processors for preparing numerous food and drink products.

The papaya thrives under cultivation. Some six to ten weeks after the seeds are planted the young plants four to six inches high are set in the field. At least three plants are set to the hill to insure one good bearing plant per hill. The undesirable plants in each hill are cut down when the first blossoms indicate their sex. In case of dioecious forms, about one male plant to each twenty females is allowed to stand to insure satisfactory fruitfulness. The hills per acre vary from 450 to a maximum of 550.

The picking of mature fruit begins in ten to twelve months from the planting of the seed and continues for six to eight months. By this time the trees have reached a height of eight to ten feet and the fruit size has diminished appreciably. The young plants set in between the old plants, three or four months earlier, are becoming crowded. The old trees are cut down and a new planting of papayas is well on its way. The papaya tree will bear for three of four years but it is found to be more economical to treat the plant as an annual. The first crop is the largest, with the finest fruit, and easiest to handle culturally.

The future of the papaya in Florida as a crop to be grown commercially holds assurance of being successful. But before it can become well established and hold its markets as do such fruits as oranges and apples, considerable work must be done on the breeding, culture and disease and pest control of the papaya.

High Efficiency Laying Houses

Condensed from The Poultry Item

C. E. Lee

WE have been building homes for hens for a good many years but a study of poultry house construction over several decades indicates that we really haven't known very much about the fundamental requirements until quite recently.

It is a fact that almost no experimental work, which could even be closely described as of a scientific nature was done on the subject until the last few years. Even now there is still a great lack of scientific data on poultry house construction as compared with such a subject as poultry feeding. However, progress has been and is being made, and the modern streamlined poultry house of today is a long step ahead of the dark, poorly ventilated, and unsanitary houses commonly seen on the great majority of farms twenty-five years ago and still surviving in some sections today.

Perhaps in no phase of poultry house construction has there been greater progress than in the matter of insulation. Years ago it was realized that freezing temperatures did not favor high egg production in hens, that even if hens did manage to lay at a high rate under such conditions, they required a much higher level of feed consumption. Experiments by Bruckner and Fairbanks at Cornell University and those reported by the writer and associates in Poultry Science over a period of years have demonstrated that while the use of auxiliary heat is very questionable in the regular floor-type laying house, it is possible to conserve the heat produced by the hens themselves and also to prevent, by every means possible, sudden temperature changes in the laying house during severe winter weather.

Proper ventilation should include provision for conserving the heat produced by the hen. Ventilation works most satisfactorily when there is the greatest differential between the inside and outside temperatures and to get this differential we must not only so design our ventilation system that the animal heat is conserved but we must also properly insulate the walls, otherwise the heat produced by the birds will soon be lost.

Insulation works both ways. It keeps the cold out of the house

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in the winter, which simply means that it keeps the heat produced by the birds in the house rather than letting it escape into the outside air. It also does a job in summer for it then prevents the excessive heat outdoors from passing into the house. Hens do no better in a house that is too hot than they will do in a house that is too cold. While hens in a cold house may continue to lay, with a heavier feed consumption than if the temperature were higher, and will continue to lay large eggs, if we make the house get too hot, we get an immediate decrease in the size of the eggs laid. Since the market price depends quite largely on the size of the eggs, it is important to do everything possible to maintain egg size at the maximum.

Poultrymen know that during heat waves in summer they get a larger proportion of small eggs and frequently a good many egg yolks are deposited on the dropping boards at night. This is not only a common experience in summer but also during periods of warm weather in the early fall when the pullets are first coming into production and the old hens are trying to still maintain a profitable level.

Insulation is of the greatest help in this connection. The exact difference made by insulation, from a profit standpoint, depends not only on the kind of insulation used, but also the general details of wall construction and the total insulating value of the wall. Many people have been disappointed with insulation because they did not use enough of it. Half inch insulating board is not, in our opinion, good insulation for a poultry house. We would recommend that *anyone using insulation board in poultry house construction specify a full one inch.* In general, we may say that one inch of insulating board is equivalent to about four inches of shavings but actually this varies according to the structure of the insulating board used.

For very best results we should have insulating materials which will prevent heat travel through the walls of our house by *conduction,* by *convection* and by *radiation.*

There are, of course, several other considerations besides insulating efficiency which must be carefully weighed when selecting an insulating material. If the structural frame of the building to be insulated is light and the span is long, it may be necessary to select materials from among a small number limited to those that are of light weight. If we have structural construction which is very strong, then we can select from among a larger number of materials, including many that are quite heavy and impose considerable strain on the framing due to their added weight. It may be mentioned in this con-

nection that insulating materials which have considerable weight will usually heat up more slowly than light-weight materials and consequently the interior of the building will remain cooler during the hot days because the heat penetrates the insulation more slowly. Likewise, heat will travel outwards from the pen more slowly during weather such as we commonly have in winter when the inside pen temperature is higher than the outdoor temperature.

The cost of insulating material is, of course, a very important point but this should be measured not from the standpoint of cost per square foot or cost per cubic foot but from the standpoint of *cost per unit of insulating value*. One material costing 8c per square foot may actually have more than twice the insulating value of another material costing 5c per square foot. Likewise, low cost local material such as sawdust, may be very cheap but may take space equal to four times the thickness of some fabricated insulating material and, in addition, the fabricated material may be moisture and rat-proof while sawdust is likely to draw moisture and rot out the building and is not rat-proof although much more rat resistant than shavings. Rats do not work as readily in any material where they are in danger of smothering.

Due to the well known conductivity of metals, it used to be thought that metals should be avoided when trying to secure insulating value. However, it has been found that metal has a real place in the construction of an insulated house. This is true for several reasons. A house with bright metal walls will reflect the heat of the sun in the summer and thus keep the house cooler while, at the same time, bright metal interior walls will reflect the heat produced by the hens back into the interior to a considerable extent. If we have inner and outer metal walls with some suitable insulating material between, such as rock wool, glass wool, cork, sawdust, shavings, or one of the other satisfactory insulating materials, we will be likely to get high efficiency in preventing heat travel by any of the three known methods.

If the bright metal in time becomes dark we can always restore its reflecting power by painting with aluminum paint.

Galvanized sheets are becoming more and more commonly used in poultry house construction and some of the finest poultry houses we have seen in recent years, both from the standpoint of beauty and also from the standpoint of durability and insulation, have been metal buildings. Unfortunately, some poultrymen have used galvanized steel sheets rather than galvanized iron. Steel does not in any

way compare with iron in rust resistance. *The best sheets for poultry house construction are galvanized iron carrying a proportion of copper and with a heavy zinc coating.* Such sheets are a far better purchase for the poultryman than the lower priced steel sheets, since they will deliver far longer and more trouble-free service.

Anyone who has had the experience of taking down an old-time barn knows that the old fashioned wrought iron nails used in such structures will usually be found in splendid condition, having resisted rust and rendered full service for many years, frequently a century or more. No one would expect the ordinary wire nail of today to render any such long service. This is because the modern nail is steel and it rusts quickly when exposed to moisture. This is typical of the difference in rust-resistance and service between steel and iron.

A poultry house not only must be rust-resistant on the outside but on the inside. The moisture given off by birds is such that there is a more or less constantly humid condition inside the laying house and this deterioration, which is also promoted by the ammonia fumes from poultry droppings, will cause relatively rapid breakdown in steel sheets, whereas galvanized iron will stand up for many years.

These galvanized iron walls are rat and mouse proof and that alone is of great importance in any poultry house. The amount of feed consumed by rats in many poultry houses is appalling. Studies recently made in co-operation with the U. S. Biological Survey, in Massachusetts, have shown that rats in a house may consume more feed in a single night than a pen of 100 hens will consume during the day. The annual toll paid by poultrymen to rats and mice is stupendous and there is no need of it!

Furthermore, rats and mice carry diseases and parasites and many an epidemic appearing on one poultry farm has been transported to another farm several miles away by rats traveling from one farm to the other.

Furthermore, metal walls reduce the fire danger and this applies not only to accidental fires started through carelessness of workers on the farm but also to fires resulting from lightning. A building constructed with galvanized iron sheets and properly grounded, offers safety against lightning, thus eliminating the need of any costly lightning rod system.

City skyscrapers are protected from lightning damage by the steel framework and, likewise, the galvanized iron sheets used in poultry house construction will protect the building if a simple grounding system is installed so that lightning charges received by

the building will be conducted through the metal to the moist ground beneath, without effect on the birds.

In this connection, there is also a very considerable saving on insurance cost where metal construction is used.

If, for any reason, a fire should start in the interior of a building with metal walls, these walls confine the fire and prevent the spread to other buildings.

It is not possible to state that a well built poultry house with galvanized iron walls will cost more or less than a building with wooden walls. Here in central New York we have a case where a poultryman has two poultry houses of practically identical design, one built with wooden walls, partly insulated, and the other built with galvanized iron walls. Each of these buildings is four stories high and houses 4800 birds. The wooden building cost considerably more than the steel building in this particular case and the difference in appearance, durability, ease of operation, ventilation, and egg production, leaves no doubt as to the superiority of the metal structure.

The writer has been in both of these buildings during very hot summer days and also during the coldest winter weather. In each case the metal building was far more comfortable and the hens maintaining a steadier and higher level of production.

There are some cases where poultrymen have paid more for metal buildings than for wooden ones, due to cheap local wood being available or, in other cases, due to far higher quality construction in the metal building, including streamlining, better ventilation, far better insulation and a house that was not only far more durable but also requiring much less expenditure for upkeep.

Metal poultry houses not only cost less to maintain than most wooden buildings, but they also cost less from the standpoint of maintaining sanitation. It is a simple matter to thoroughly wash down and disinfect the interior of a house with metal walls but, in the ordinary wooden building it is quite a different matter. Cracks and crevices offer lodging for dust, bacteria, and red mites in the average wooden building, whereas the smooth, metal walls of the up-to-date poultry house offer little or no lodging for any of these.

Another type of construction is that which employs wood framing and wood or composition walls with metal-coated paper insulation. This metal-coated paper carries a surface made from aluminum foil some 95/1000ths of an inch thick. Owing to its highly polished aluminum surface, it is claimed to have an insulating efficiency equal to 20 inches of concrete, ¾ of an inch of cork, 2½ inches of wood, or .8 of an inch of

an insulating board of average construction.

This material is, of course, waterproof and therefore loses none of its insulating efficiency by reason of moisture absorption.

The insulating efficiency of this aluminum foil or metallation provides a decided contrast to most other insulating materials since it will reflect about 95% of all radiated heat. The U. S. Bureau of Standards in its circular No. 376 "Thermal Insulation of Buildings," states that: "Radiation is largely responsible for the ineffectiveness of air spaces in frame or other hollow walls." They also state that: "From 50% to 80% of the heat transfer through such walls takes place by radiation."

This metal-coated paper insulation is not only water-proof but also wind-proof, odor-proof, and neither attracts nor harbors vermin. It is also resistant to fire.

It is significant that Admiral Byrd selected this metallated material to insulate his huts to be built in the Antarctic, as a protection from the intense cold. This was done not to keep the cold out but to keep the heat from his small heaters from escaping through the walls to the outdoors. Likewise, we are interested in conserving the small amount of heat produced by the hens and preventing its escape through the walls of the poultry house in cold weather.

A manufacturer of this aluminum foil insulation states that this material is widely used in storage rooms and containers to keep frozen products in proper condition by preventing the warmer outside air from entering the cold compartments.

Research workers have estimated that with the average dwelling house the approximate responsibility for heat losses is 70% by radiation and 30% by conduction and convection. In the use of this aluminum foil insulation we try to provide similar conditions to that maintained in the average vacuum bottle. The vaccum bottle is really two bottles, one inside the other. The space between the bottles is practically a vacuum since most of the air is removed by suitable apparatus so as to stop the transfer of heat by conduction and convection. Radiation would, however, make these bottles inefficient were it not for the fact that the bottles are provided with highly polished metallic surfaces to stop the loss of heat by radiation. This aluminum foil insulation is applied between the inner and outer walls so as to provide, as nearly as possible, the conditions of the vacuum bottle.

Aluminum foil insulation is prepared not only in the form of coated sheets but also in plain aluminum foil. In either case it may readily be fitted between the walls so that a properly insulated

wall is obtained. It may also be used to insulate water pipes, heated water fountains and other equipment.

The day of metal in poultry house construction is here!

Double Pasture Rotation

Condensed from Capper's Farmer

C. K. Ackers

HOPE for dairy profit is lush, dependable pasture, Tom F. Campbell declares. It maintains milk flow better than any other feed; involves no cultivation or harvest expense; keeps land covered and retards erosion to a minimum loss of soil. On his farm, in Creek county, Oklahoma, pasture is the only crop. But, he warns, a specific system of management is necessary to maintain profitable grazing.

By such management he has been able to make the 113 acres of sandy loam upland and bottom more profitable than either a wheat farm or an alfalfa farm which he owns. "In fact," he said, "I don't know any crop which will pay as well as pasturage grazed by dairy cows."

At the time, he had been keeping 70 cattle, all ages, on the place, buying the ingredients for his grain ration and delivering 300 quarts of milk daily. Since then he has reduced the milking herd to conform more nearly to the grass capacity of the farm and to avoid such heavy purchases of grain. Milk deliveries have been reduced to 125 quarts a day, truck travel from 65 to 17 miles a day, and the farm and herd are more profitable than before.

He practices two rotations as to crops and divides the grass acreage into small lots for rotation grazing. Cows are turned on to each area one day a week. Three permanent Bermuda pastures are available for wet weather or when the sowed pastures are developing.

The first combination of sowed pasture is semi-permanent, Bermuda grass and winter barley, in that the Bermuda requires no reseeding. Fields set to this grass, which is considered a pest in some regions of the South, especially where row crops are grown, are plowed during Sep-

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tember or the first fifteen days of October. Breaking is deep if moisture is plentiful, shallower if otherwise, but should the soil be dry, he waits for rain. A seedbed is worked down and a relatively heavy seeding, 2½ bushels an acre, of winter barley is made. Under normal growing conditions the barley will come on to supply grazing in a month, and thruout winter. Bermuda begins with the first warm weather and replaces the barley as it fades out. This combination affords continuous cover, nearly continuous pasture and is repeated year after year.

The other rotation consists of Italian rye grass, an annual, and Sudan grass. Italian rye is sowed in September or October at the rate of 25 pounds an acre on a well-prepared seedbed where Sudan was grown in summer. The grass grows all winter in the latitude where he lives, and Mr. Campbell insists it affords the most abundant grazing of any crop he can grow. In a good season it will support three head an acre. But it goes to seed and dries up by June 1.

So, as the cattle graze it off, he begins plowing it down in ten-acre tracts. The first field is turned just as soon as weather and soil are warm enough to stimulate quick germination and growth of Sudan, April 15 to May 1. Thereafter each week an additional plot is plowed, prepared well and seeded; so that by the time the last plot of Italian rye is turned under the first seeding of Sudan will be ready.

Approximately equal areas are devoted to the two combinations, Italian rye-Sudan and Bermuda-Winter barley. The barley is preferable to wheat because it stands up better on light soil such as he has, and that is an important consideration in a sowed pasture crop. Upland is permanently sodded to Bermuda. Fence rows, nooks and corners are set to Korean lespedeza which, of course, renews annually and persists in hot weather. Rye grass would reseed to make a new pasture each winter, but he believes mechanical seeding is more economical in that he would lose use of the land during a period while the crop was maturing and perhaps throughout the summer because by the time rye grass seed was ripe, weather would be hot and soil dry so plowing would be difficult and Sudan might not germinate. Rye grass and Korean in timber-shaded areas renew themselves annually.

Under this system, with droppings from grazing animals, he asserts pastures are becoming gradually better. A trap is provided at the farmstead for corralling and holding the cattle at milking time and for shunting them to the various grazing areas with which it is connected by a series of gates and lanes.

"Grass is the backbone of my farming system on this place," he concluded, "and the backbone of my dairy program. Without it I couldn't remain in the business. Every available corner is seeded. If weeds develop, we use the mower."

The pasture system was worked out with the suggestions of Sam B. Durham, pasture specialist for Oklahoma A. & M. College. Inasmuch as cows are in the field practically all the time, there is but little manure to spread, perhaps a trailer load weekly, removed after each milking. Consequently, the fly nuisance is reduced to a minimum. Ingredients of the grain ration, which he mixes himself to a 21 per cent protein strength, are purchased, as is also a limited quantity of alfalfa hay to be fed on stormy days when it is desirable to shelter the cows. Concentrate allowance is limited, of course, because with adequate pasture the cattle do not require as much, by half, as if they were stall fed.

Protein for Hogs on Rape Pasture

Condensed from Hog Breeder

D. W. Johnson and E. F. Ferrin

University of Minnesota

WHILE hogs are not grazing animals as are cattle and sheep, they nevertheless are able to make considerable use of crops such as alfalfa and rape as many experiments have demonstrated. Both of these crops make excellent pasture for hogs, although it is the opinion of some that little use will be made of rape if the hogs have plenty of other feed available. However, records at this experiment station of the consumption of this crop by growing pigs attest to its palatability. These records were obtained by the daily feeding of a weighed amount of freshly cut rape to six lots of pigs fed a suitable ration in dry lot. The average consumption of rape amounted to 16 per cent of their feed intake with no lot eating less than 14 per cent. Thus, because this crop grows so rapidly under favorable conditions, it probably only appears that hogs do not eat it readily.

Reprinted by permission from the Hog Breeder, Chicago, Illinois, February, 1941

Hogs on pasture will be on "cleaner" ground, and because immature pasture crops contain approximately 25 per cent protein, there will be a reduction in the amount of a protein supplement needed for each 100 pounds of gain. Sometimes the mistake is made of putting the pigs on pasture and giving but little additional feed. This will invariably result in such a reduction in rate of grain that a much larger total amount of feed will be required to get each pig to market weight than would have been the case had more feed been given. The question then arises as to how to make the best use of pasture for market pigs. By "best" use should mean the maximum pasture consumption without an appreciable reduction in the rate of gain of the pigs.

In the first place, since grain is the basic feed for all growing animals, it should be liberally fed. A simple way of doing this is with the self-feeder. Although, as has been pointed out, pasture crops are high in protein, it is not possible for pigs to eat large enough quantities to meet their needs for protein, especially when the pigs are under 100 pounds. Many experiments have demonstrated this. How much of a protein supplement to feed, however, is quite a different question. The usual recommendation is to reduce the protein supplement so that the total ration would consist of approximately 95 per cent grain and 5 per cent protein supplement. While this may be fairly accurate it is a procedure that would be seldom followed because of the time involved in making calculation and weighing both grain and supplement. A much more simple method would be to self-feed the grain and hand feed the protein supplement, providing gains could be made more cheaply than by self-feeding it. The following experiment, therefore, was set up to answer the question as to how to feed the protein supplement to pigs intended for market when they are on good pasture and receiving all the grain they care to eat.

Four lots of seven pigs per lot were used. Each had access to excellent rape pasture and were also self-fed, free-choice ground corn, salt, and bonemeal. Bonemeal was used instead of limestone because pasture crops are low in phosphorus. Enough of this mineral, as well as calcium, would not be furnished unless a liberal amount of a protein supplement, containing at least one-half of an animal by-product concentrate were fed. Lot 1 did not receive any protein supplement. Lot 2 received 0.2 of a pound per pig each day. Lot 3 received 0.4 of a pound per pig each day, and Lot 4 was self-fed the supplement which consisted of equal parts of dry rendered tankage and soybean oil meal.

The results of this experiment are shown in the table. Lot 1, gaining 0.81 of a pound per pig per day, did as well as could be expected. While it was known that this lot would not grow well without some protein supplement, it was so fed as a demonstration of this fact and also in order to better evaluate the performance of the other lots. Lot 2 gained almost 50 per cent faster than Lot 1, which is a good illustration of what a small amount of a protein supplement will do. Lot 3 did not do as well as expected, particularly in view of the fact that Lot 4 gained almost 75 per cent faster than Lot 1 and almost 20 per cent faster than Lot 2.

Several of the pigs in Lot 3 did not gain as they should have. This was obvious from their weight records taken every two weeks.

Of interest is the fact that Lot 1 did considerable rooting. After the close of the experiment it was self-fed the protein supplement for two weeks. During this time this lot ate 1.3 pounds per day of the supplement, 0.7 pounds more corn than during the previous two weeks and gained an average of 2.2 pounds per pig per day as compared to 0.93 pounds during the previous period.

From this experiment it is obvious that when it is desired to get pigs up to market weight as soon as possible, a protein supplement is necessary even though the pigs are on good rape pasture and are receiving a calcium and phosphorus supplement, salt, and a full feed of grain. This would also be true when the pasture is some other crop such as alfalfa. An addition of only 0.2 of a pound of a mixture containing equal parts of dry rendered tankage and soybean oil meal increased the rate of gain by almost 50 per cent. This small amount of protein, consequently, would reduce considerably the time required to get the pigs to market weight. Because of the poor growth of several of the pigs in the lot receiving 0.4 of a pound of the supplement per pig per day, it would not be determined whether this amount of supplement would result in cheaper gains than when it was self-fed. By the latter method of feeding the supplement to Lot 4 the pigs ate 0.55 of a pound per pig daily and gained 20 per cent faster than Lot 2 with much less feed required per 100 pounds of gain. It seems probable that if cheaper gains can be obtained by limiting a protein supplement to pigs on pasture than by self-feeding it such pigs accordingly must eat more pasture. This in turn means that fewer pigs per acre of pasture could be used as compared to when the supplement was self-fed.

LIMITING THE PROTEIN SUPPLEMENT* FOR MARKET HOGS ON RAPE PASTURE

(July 10–October 16, 98 Days)

Lot	Ration**	Av. initial weight, lbs.	Av. final weight, lbs.	Av. daily gain, lbs.	Av. daily ration, lbs.		Feed eaten per 100 lbs. gain, lbs.			Feed cost per 100 lbs. gain***
					Corn	Protein Supplement	Corn	Protein Supplement	Total	
1	Ground corn, rape pasture	36.45	116.22	0.81	2.93	....	361.73	....	361.73	$4.56
2	Ground corn, 0.2 lb. protein supplement per pig, rape pasture	35.22	151.78	1.19	4.12	0.20	346.22	16.81	363.03	4.42
3	Ground corn, 0.4 lb. protein supplement per pig, rape pasture	34.67	151.56	1.19	3.89	0.40	326.89	33.62	360.51	4.55
4	Ground corn, protein supplement self-fed, rape pasture	35.62	171.52	1.39	3.73	0.55	268.35	39.57	307.92	3.98

*The protein supplement consisted of equal parts of dry rendered tankage and soybean oil meal.

**Salt and bonemeal were self-fed free-choice but under the conditions of the experiment it was not possible to keep accurate records of their intake. Only Lot 1 ate an appreciable quantity of the bonemeal.

***Prices used: Corn 56c per bushel; tankage $45 per ton; soybean oil meal $30 per ton; pasture 25 cents per month per pig.

Tomato Plants

Hardening tomato plants, either by exposure to low temperatures or by starvation, before transplanting in the field, is not only a waste of time and effort but actually reduces the crop yield.

So say the results of experimental work conducted by Dr. E. P. Brasher, West Virginia Experiment Station. Tests which have been repeated each year since 1937 show that tender plants oftentimes yield as much as a ton per acre more than those which have been hardened. As the hardening was increased, or intensified, the yield of early fruit was decreased.

Furthermore, tender plants were able to withstand just as low temperatures in the field, and were no more subject to dry weather injury than hardened plants.

—Farm Journal

Performance Tests for Stock Horses

Condensed from The Extension Animal Husbandman

F. W. Beall

Extension Animal Husbandman, Oklahoma Argicultural and Mechanical College

IN Oklahoma the breeding and production of light horses of the various types has assumed considerable importance in recent years. Many ranchers in the State have followed the policy of producing their own stock horses in addition to producing a surplus for sale. There has been a particularly good demand in recent years for stock horses for use in parades or in rodeo work. The establishment of a large number of riding clubs and round-up clubs in towns and cities over the State has resulted in a substantial demand for stock horses with style, character, and the right conformation. This market is very profitable and appears to be substantial and permanent for the breeder who produces horses that will meet the requirements of riding clubs and rodeo performers.

In the Southwest, stock horses are valued primarily for intelligence, endurance, and the ability to withstand hard work. The exact type, size, and conformation of the horse are matters that depend on the locality and the type of work that is to be done. Ranchmen in all sections are agreed, however, that a good stock horse must have sufficient intelligence or "cow sense" to take training readily and to understand the particular job that is being done in such a way that he will go through the required maneuvers with very little guidance from the rider. A good stock horse must also have sufficient endurance to withstand a long day of riding over difficult terrain on short feed and under extreme weather conditions. He must be sufficiently agile and active to perform the fast and difficult work of cutting cattle from a herd or "working" cattle in a corral. Cutting pens and squeezing chutes have eliminated some of the heavy work that was formerly required of cow horses, but most ranchmen still prefer a horse of sufficient size to hold or throw a mature cow or steer if necessary. It is because of the fact that the value of the stock horse depends more on these factors than it does on type and conformation that breeders have been slow to establish breed organizations and type standards for their favorite stock horses. The recently established Ameri-

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can Quarter Horse Breeders' Association has set up definite type and size standards for the Quarter horse, which is one of the most popular types of stock horses. This association emphasizes the fact, however, that intelligence and performance in the Quarter horse are equally as important as type and size.

The part that the Extension Animal Husbandry Department has played in conducting performance tests for stock horses dates back to approximately 2 years ago when the Chamber of Commerce at Nowata, Okla., made plans for conducting a One Hundred Mile Trail Ride. The Extension Division was asked to co-operate in conducting the contest in such a manner that it would be an educational event for horsemen and might result in some improvement in the breeding and production of stock horses. The wisdom of extension co-operation with such an event might at first be questioned, but because of the fact that this particular trail ride was conducted largely by and for ranchmen and horse breeders, it was concluded that if it could be kept on the proper basis it would be a suitable field for Extension activity. Ed Warner, county agricultural agent of Nowata County at that time, was instrumental in preparing plans that were designed to make the event a performance test rather than a horse race. Valuable suggestions were also secured from Wayne Dinsmore, Secretary of the Horse and Mule Association of America. At the first Trail Ride in May, 1939, the course provided for a 40-mile ride each of the first 2 days and 20 miles on the final day. It was apparent from the first that some riders might misuse their horses if the results were based on speed alone. For this reason, provision was made for grading the horses on condition as well as elapsed time. The rules provided that, "Awards shall be made on the basis of 40 points for condition and one point for each 6 minutes or fraction thereof that the horse finishes under the 20-hour limit for the 3 days of the ride." The official judges were charged with the responsibility of grading the horses on condition at the end of each lap. This provision was less effective than expected for the reason that the distance was covered in so short a time that the credit for time more than balanced the credit for condition. The horse making the fastest time covered the 100-mile course in 8 hours and 12 minutes, thus receiving 118 points for time. This time credit naturally assumed more importance than the 40 points allowed for condition.

Our experience during the 2 years this trail ride has been conducted indicates that even more weight should be given to the condition of the horses. There re-

mains some inclination among some of the riders to misuse their horses if the judges are not very strict in discounting points for condition. The officials who have sponsored this contest are interested in continuing to conduct it each year and want to change the rules where necessary in order to continue the event as an educational feature for horsemen.

It has been observed in the two rides held thus far that where speed and endurance are the major considerations, horses with considerable Thoroughbred blood have the advantage. Thoroughbreds that are rather tall and long-legged have placed up in both of the events thus far. This type of horse is not best suited for the use to which a stock horse is put. For this reason, it has been suggested that various classes be provided for the event, such classification to be based on height, weight, and other factors. Since the American Quarter Horse Breeders' Association has set up definite standards for registration in its organization, it has also been suggested that a class be provided for Quarter horses or horses that conform to the type and size standard adopted by the Association.

Another event that has become popular in recent years is the cutting-horse contest. This is an event designed to test the intelligence of the horse and his ability to perform satisfactorily under the crowded conditions of a corral. In this event, the cattle are held in a corral or arena, and the rider is required to select a single steer and cut it from the herd and drive it through an open gate in the opposite end of the arena. During the course of the event, the rider may be required to remove as many as three or four steers from the herd. A referee is present in the arena and may obstruct the gate in such a manner that the steer will be turned back if, in his opinion, the rider or horse has not given a satisfactory performance. The results are based on the disposition, speed, agility, and intelligence of the horse and the ability of the rider. The type or conformation of the horse has no significance in this event. This is probably one of the most satisfactory contests we have from the standpoint of determining the intelligence and ability of a horse.

Since this contest is fairly short, it is very little indication of the endurance of the horse or his ability to stand hard work. Such an event coupled with the trail ride should give an accurate indication of the ability of a stock horse to perform all the duties that will normally be assigned to him under ranch conditions.

Since contests and events such as those described have been conducted under extension supervision only during the last 2 years, it is perhaps too early to determine

what definite results may be obtained in improved breeding and management. Considering the interest that has already been aroused among horsemen and breeders, it appears certain that a combination of these events can well develop into a form of progeny testing and type study.

Importance of Soil Pore Space to Newly Planted Trees and Shrubs

Condensed from **Farm Research**

H. B. Tukey

THERE is an old adage that goes something like this "Make the tree hole as large as the orchard." Another, common in nursery circles, says "Keep the dirt moving"; and yet another says, "Cherry trees start well in a fence row." Like so many sayings, they have some basis in fact, and all three seem to point in the direction of the renewed interest in aeration of the soil and in providing a greater pore space in the soil in which a plant is set.

Of course, a good garden soil, rich with organic matter and in good physical condition, or a sandy soil, may both provide sufficient space between soil particles for the movement of air and oxygen. But there are other soils, frequently those close to a building foundation or fill, or heavy clay, or a puddled soil, in which the soil particles are so closely compacted that pore space is small and oxygen supply is insufficient for good root development.

For example, in planting tests made at the New York Agricultural Experiment Station, not only was the pore space reduced from 57 per cent in soil with normal moisture content to 45 per cent in soil with high moisture content, but also what little oxygen there was present in the limited pore space of the latter soil was reduced from 20 per cent to 10 or 12 per cent.

Now it is well known that roots require oxygen for development. Dr. Damon Boynton, of Cornell University has proposed that there may be several levels of oxygen required by roots, depending upon their activity. That is, whereas 2 or 3 per

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cent oxygen may suffice for survival of roots of well-established plants, perhaps a higher oxygen content is required for initiation of roots and rapid root development.

At all events tests at this Station in which material such as a good grade of granulated peat moss has been mixed wet with the soil in the planting hole to lighten the soil and improve its physical condition, have shown a greatly improved stand and growth of plants—especially on heavy soils in wet seasons when the soil is likely to be saturated with moisture or "water-logged." Trees of apple, peach, pear, plum, cherry, oak, walnut, and elm have all responded to use of a 12-quart pail of wet granulated peat moss for each tree, or at the rate of about 1 part to 4 of soil by volume. More recently, Mr. K. D. Brase of this Station has shown a similar benefit in shoot growth, in root development, and in flower production of roses from improving the physical texture of the soil with a good grade of peat moss, thoroughly wet when used.

The more thorough the mixture of soil and peat, the better the results. In planting a tree, it is possible to shake the wet peat moss into the tree hole as the soil is being put back; or the two materials may be mixed and then filled into the tree hole. The important point is to construct a "chimney" of open, porous material extending from the surface of the soil down to the bottom of the tree hole—not merely dumping the peat moss into the bottom of the hole.

Interestingly enough, this practice has not resulted in the roots developing exclusively in the peat-soil area. Instead, the roots have spread laterally into the adjoining soil mass to give a plant with extensive root spread and one better able to withstand summer drouth.

Besides the improvement in aeration, this treatment has made planting easier, since the tree or plant is set tightly in a springy, spongy mass of moist material; and in midsummer the "chimney" of peat-moss mixture has seemed to catch the moisture from a light summer shower and otherwise permit better penetration of water into the soil near the devloping roots.

To summarize the case, it is thought that the wet peat moss is beneficial because (a) it permits better contact of roots with soil moisture immediately after planting; (b) improves aeration early in the season, favoring rapid root development; (c) provides easier penetration of rainfall to the area occupied by the roots and less run-off of surface moisture; and (d) makes it easier for the roots to develop because of decreased density of the mass.

What's New in Vegetable Gardening

Condensed from The Ohio Farmer

Wilbert Schaal and H. D. Brown

QUITE apart from cultural practices and yet perhaps even more important to both the ultimate producer and consumer is our newest knowledge of the food value of vegetables.

Vegetable gardening research laboratories have endeavored to combine high nutritional value of vegetables together with low cost of production, so that the average housewife will be able to meet her family's food requirements from the standpoint of health and low cost.

In a paper presented at the 1940 convention of The Vegetable Growers' Association of America, Dr. Pauline Beery Mack, of the Pennsylvania State College, groups the major vegetables with their nutritional values into the following groups:

The potato is a relatively high energy food, with but little supplementary value as a protein. Contrary to the common belief that potatoes are fattening, it may be said that they are no more so than an equivalent amount of calories from any other source. No food is fattening unless it is added to a diet that is adequate without it.

Beans and peas are of high protein and caloric value and contribute to the mineral and vitamin content of the diet. Both beans and peas, particularly soybeans, are good sources of vitamin B, which is the anti-neuritic vitamin enjoying such wide attention at the present time.

Leafy, green, and yellow vegetables include such a wide variety of foods as asparagus, broccoli, celery, Swiss chard, endive, collards, yellow sweet corn, beets, turnip greens, kale, lettuce, parsley, snap beans, spinach and water cress. Vitamin A is one of the chief ingredients of these foods. The leafy vegetables also supply a wide variety of nutrients.

Tomatoes rank with the citrus fruits among the highest sources of vitamins.

Many outstanding contributions dealing with plant nutrition have originated at the Ohio Agricultural Experiment Station and the Ohio State University. Beets canned from a test plot receiving a complete fertilizer were well colored, though the canned beets from plots with a lack of either nitrogen, potassium, or phosphorus were badly discolored.

Reprinted by permission from The Ohio Farmer, March 8, 1941

The well fertilized beets seemed to have a stronger flavor. Canned spinach grown with a nitrogen deficient fertilizer was light green in color and of generally poor quality.

Of all the other new advances in plant science, perhaps the most striking deal with the environmental effects on the quality, and yield of vegetables.

It is well known that certain vegetables produce their best growth during long daylight periods, i. e., more than 12 hours. Onions, for example, produce large bulbs with long days and fall back into a vegetable growth when grown in short periods of light. Spinach and the radish are other vegetables that require less than 12 hours of daylight for vegetative growths, but go to seed if the daylight periods are longer than 12 hours. The artichoke, cucumber, and potato are examples of vegetables that will make satisfactory growth during short days.

Again environment, in the form of temperature, influences the type of growth of most vegetables. Cabbage, celery, onions, and beets produce a crop of seed rather than edible portion at temperatures of 45-55 degrees F. Lettuce, on the other hand, produces seed at high (75 degrees F.) temperatures.

Spinach, cabbage, radishes, carrots, salsify, lettuce, endive, onions, turnips, parsnips, and pears are classified as cool season crops, and do not thrive with summer heat.

Ranking high in the vegetable industry is the development of new and improved varieties of sweet corn and lima beans. Much progress in hybrid development has resulted in several outstanding strains of sweet corn, especially the Golden Cross Bantam. It is now the most extensively used hybrid, and is extremely uniform in plant and ear characteristics, and in maturity. The stalk is sturdy and upright, and highly resistant to Stewart's disease. Golden Cross is widely adapted to canners' use and is excellent for market gardeners. The hybrids Ioana, Marcross, Spancross and Carmelcross are all new varieties, highly resistant to drouth and wilt, and especially suited to either gardeners or canners.

A new variety of lima beans, commonly called the "Baby Lima" has been developed recently, and is much in demand, especially in the more specialized urban areas. The bean has been bred particularly for increased yielding power and uniformity of maturity. The plant is small, dark green, erect, bushy, and very early. The pods are flat, containing three or four flattish, small, oval beans.

With disease resistance being the main objective, Fusarium resistant cabbage, watermelons,

and tomatoes are now in general use. The Marglobe tomato, introduced by the U. S. Department of Agriculture, has come into wide use by truckers and shippers, and by canners in some sections. The plant is vigorous, with heavy foliage, resistant to Fusarium wilt and nail-head rust. The fruits are medium large, nearly globular, deep red, smooth, solid, with thick walls and cross section, and of fine quality.

With the realization arising that nature is rapidly depleting our natural supply of soil elements through erosion, soil conservation practices, contour farming, and drainage constitute major improvements in the vegetable gardening industry. At the Ohio State University's horticultural gardens, soil physicists estimated that sheet erosion was taking its toll to the extent of two tons of top soil per acre, annually. Continuing at this rate, in a few years the gardens would be worthless. A drainage system has been installed, consisting of four-inch tile 32 feet apart, following the natural slope of the land. This system has eliminated sheet erosion.

Ohio tests have proved that row applications of fertilizers on relatively infertile soils are more economical than broadcast applications. These bands are usually more effective if placed on both sides of the row and at a depth of two to four inches. In few cases can fertilizer be applied with the seed, as large amounts of soluble nitrogen and potassium are quite injurious to the small seedling.

Oats and Winter Vetch

Larger yields and higher protein content are the advantages found for a combination of oats and winter vetch as a spring-seeded hay crop in comparative tests with oats alone or oats in combination with field peas or spring vetch. Analyses of the hays show that oats and winter vetch have an acre-yield of protein more than forty per cent higher than any of the other crops tested.—*New Jersey Farm and Garden*

Cover Crops for the Vegetable Garden in the Northeast

D. G. Lauck

CULTIVATED crops deplete essential soil organic matter. Unavailability of manures in large quantities makes the use of a cover crop necessary to provide organic bulk for efficient soil production and conservation.

The turned under cover crop, with its resulting humus, encourages growth of soil micro-organisms which make native soil fertilizing elements more available to the crops which follow. These microscopic organisms also break down organic compounds, and mineral nutrients to forms essential for plant utilization. In turn these organisms die and their nutritive elements become quickly available for plant growth.

During fall, winter and early spring, the cover crop will hold elements of fertility by using them in its own development. After the crop is turned under in spring these elements will be available shortly for growth of the pay crop. Also, mechanical erosion, with its loss of top soil caused by fall and spring rains, will be greatly lessened. The use of a cover crop will not materially add fertilizing elements to the soil, but will prevent the leaching of those elements present, an exception being the legumes, which normally are capable of increasing the nitrogen content of the soil. This fact is important because nitrogen is the most expensive and unstable of fertilizing elements. After the cover crop is turned under, the absorptive capacity of the organic bulk will help hold soluble fertilizing elements until they are needed by the root hairs of the pay crop plants.

The physical condition of either light or heavy soils is improved by the incorporation of the cover crop. Decaying organic matter acts as a sponge and with its absorptive capacity, it greatly benefits sandy soils. The organic bulk of the cover crop tends to make the heavy soils less dense and thus more workable. In the case of both types of soil the organic matter darkens the soil and increases its heat absorbing qualities, which allows the soil to support plant growth earlier in the spring. The subsoil is broken by penetration and decay of cover crop roots, thereby allowing better water and air infiltration.

Essentials of a Cover Crop Plant

It is usually desirable to select a cover crop which will grow when the normal pay crop growing season is practically finished. It should survive the average winter and obtain sufficient growth by early spring, when it is turned under, to make way for the pay crop. A plant that will decay quickly, when incorporated in the soil, is essential. Slow decaying organic matter will interfere with early development of the subsequent pay crop. The ideal cover crop plant must make most of its growth between July 15 and October 31 and between March 15 and May 15.

It is desirable that a mixture of plants be used. The plant top development should be varied to avoid competition for sunlight. Root systems, including both shallow and deep types, are suggested so that soluble fertilizing elements will be captured within as large a volume of ground as possible. The cover crop mixture should include a grass or grain with legumes. A mixture is suggested because under adverse conditions it is unlikely that all types will be seriously affected.

The legumes sweet clover and hairy vetch should be inoculated when used for the first time. Plantings of these legumes on the same plots in succeeding years will fix their nitrogen nodules naturally. Incidentally, sweet clover utilizes the same type of bacteria as alfalfa, and hairy vetch the same type of bacteria as the garden pea.

Should the addition of a true clover be desired in the cover crop, the use of Mammoth Red Clover is suggested.

If the ground is to be fall plowed, buckwheat or sudan grass planted three to four weeks before plowing (September) will normally obtain a height of 1 foot to 2 feet. When plowed under in the fall, this will give satisfactory bulk of organic material, which will also help hold soil in place over the winter.

Cover Crop Procedure

Plowing is not necessary or desirable when planting a cover crop. Ground that is plowed during late summer or early fall may dry out excessively and delay germination of cover crop seeds. Three methods of planting are suggested and in each case the

Seed Mixture for Cover Crop

July Planting	=	Timothy — Hairy Vetch — Sweet Clover
Aug. Planting Sept. Planting	=	Domestic Rye Grass — Hairy Vetch — Sweet Clover
Oct. Planting	=	Domestic Rye Grass — Hairy Vetch — Rye

former pay crop residue is left on the plot, unless it is necessary to dispose of it due to excessive disease or insect infestation. Cover crop seeds may be planted between the rows of the pay crop during the last cultivation. Seeds may be sown and ground gone over lightly with disc. Then roll to compact soil and effect speedy germination. On small plots it may be advisable to sow seed by hand and scratch the ground with hand cultivator. Soil should be rolled if possible.

With normal heavy fertilized vegetable plots, it is not necessary to use a balanced fertilizer on the cover crop, as the plants will utilize fertilizer left by the previous pay crop. If addition of superphosphate is necessary, apply over plot while seeding cover crop. If an application of lime is necessary, apply limestone over the plot after cover crop is 1 inch to 2 inches in height and before freezing weather. Apply Cynamid just before turning under cover crop in spring. This lime-nitrogen compound will take care of any temporary excessive nitrogen requirements of the organic matter during early decaying period. In this manner the early development of the pay crop will not be retarded. Later in the season the nitrogen of both the Cynamid and decayed organic matter will be available for growth of the pay crop. The Cynamid is turned under *with* the cover crop.

The cover crop should be thoroughly incorporated in the soil. The ground should be rolled as soon as possible to conserve moisture and hasten the decay of the cover crop. Do not plant seeds of the pay crop until cover crop has been turned under for approximately two weeks. It is not advisable to allow cover crop to grow too large in the spring (maximum 2 feet). Younger plants decay more quickly and return fertilizing elements to the soil in time for use by the following crops. Excessive growth turned under may interfere with early development of succeeding crops and may also seriously deplete the moisture content of the soil. If growth is allowed to proceed until late in spring seeds may form which will act as weeds in the vegetable crops which follow.

Frame Gardens

Condensed from The Acco Press

IN sections of the South where March winds are bad, summer suns are hot, and winter brings subfreezing weather, the frame garden provides a supply of fresh vegetables throughout the year.

The February, 1940, issue of the *Extension Service Review* says:

Frame gardens are growing vegetables for farm families in Texas, in bad weather and in good weather, whether it rains or not. Home demonstration agents are enthusiastic about the method, and frame gardens have been planted in 200 Texas counties with 10 to 200 home demonstration club members in each county planting such a garden.

The home demonstration frame garden seems to go back to Mr. and Mrs. Charley Heck, of Castro County. The Hecks moved to the plains of Texas from the Midwest. They were wheat farmers. Limited rainfall, winds, and blowing sand made the growing of vegetables difficult except in favorable times of the year. Mrs. Heck realized that green vegetables were needed every day rather than just every once in a while if her family's health was to be assured. Therefore the coldframe was put to use growing vegetables. It gave some protection, and it required less water.

Soon they had not one structure but a whole back yard full, and not one or two vegetables but a number—asparagus, beans, cabbage, carrots, chard, kale, lettuce, endive, Chinese cabbage, dandelion, sorrel, mustard, English peas, yellow squash, beets, radishes, tomatoes, salsify, and onions.

Various materials—glass, cello-glass, and muslin—were used as covers. On cold nights, additional protection was provided. During the favorable summer months, an endless variety of vegetables was grown in generous amounts in the open.

Later, a home demonstration agent, Izora Clark, was employed by Castro County. The methods followed by the Hecks came to her attention. She studied them and talked about them to other women and to other county home demonstration agents. The practice began to spread.

In 1935 agents began to mention the gardens in their monthly reports.

"Sixteen varieties of vegetables and seven kinds of flowers were planted in a coldframe fifteen feet wide and forty-two feet long

Reprinted by permission from The Acco Press, Houston, Texas, March, 1940

by Mr. and Mrs. M. O. Canady on February 26," reported Sylvia Rodd, home agent of Lynn County, in early 1935. "This is the method our home demonstration clubwomen have of raising an early garden.

"The soil is first spaded and fertilized, and then the rows are marked ten inches apart. This made, at the Canady's, fifty rows, fifteen feet in length. The coldframe was covered with canvas at a cost of $3.59. The frame was built from scrap lumber.

Miss Rodd reported, too, that there were thirty-seven of the gardens in use in Lynn County. One club member, Mrs. A. L. Dunagan, canned 70 quarts of spinach from her coldframe.

Interested in the frame gardens, Grace I. Neely, extension specialist in food preservation, visited Lynn County in 1936 to see what was going on. She found all the claims for the miniature gardens true; and, in addition, she found that the vegetables were of surpassing flavor and tenderness. The extension organization began to push the practice.

In the latter part of 1937, the necessity for having a definite name for the device became evident. The term, "frame garden," had been used here and there. It seemed to be the best name to use.

In early 1938 a printed leaflet bearing the title, Frame Garden Suggestions, was published and a special drive was made to get frame gardens planted, with the result that 3,122 were reported for 1938.

Energetic 4-H Club members of the Thornberry community in Clay County supplied vegetables for their hot school lunch last year from a frame garden which they had built and planted under the direction of the county extension agents, M. S. Duncan and Ruby E. Hayden. The garden, 4½ feet wide and 48 feet long, was located on the south side of the schoolyard. Its burlap cover was removed whenever direct sunlight was available.

The women of Scurry County are enthusiastic about this new type of garden because in the past, wind, hail, sand, and lack of water have greatly limited the garden growing season. Nellie Cundiff, home demonstration agent in Brooks County, grew vegetables for demonstration purposes in a frame garden on the courthouse lawn. The garden aroused a great deal of interest among rural visitors when they came to town.

In one extension district more than 1,500 frame gardens were made and planted last year.

The annual report of Miss Jennie Camp, specialist in home production planning states:

Mr. H. P. Hulsey, truck farmer about four miles north of San Angelo, began raising vegetables

in frame gardens as protection against insects, but he found it so profitable in advancing crop production that he recommends it as the best means of quick and sure growth for market. Spinach will be more tender, will have a 300 per cent increase in yield, and will be cleaner than when grown in the field garden. "Turnips with tops were grown in 32 days, while radishes ready for market were harvested in eleven days," Mr. Hulsey reported.

Here are a few suggestions on how to build a frame garden taken from Extension Service Circular No. C-121:

Making the Frame Garden. The dimensions of the frame garden should be 4 to 5 feet wide, and of any desired length. The usual length is 20 feet. Frames 4 to 5 feet in width are better than wider ones because of the convenience in cultivating and harvesting from each side.

Scrap lumber or any other available material may be used in constructing the side walls. If new lumber is used, 1 x 12 planks may be nailed together to make a side wall that is 12 inches in height. Strips 1 x 1 inch should be nailed across the frame every 4 feet to support the cover. A good grade of cheese cloth or muslin cloth should be tacked on one side of the frame and some means of holding the muslin down over the other side and ends should be provided. Note: the frame should be kept open as much as possible to give the plants ample sunlight.

Lath Covers. In localities of extreme summer heat and drouth an open frame cover with lath strips will break the direct rays of the sun, provide summer shade, permit free air circulation and cut the rate of moisture evaporation. The top and sides of the frame may be covered with netting wire to keep out small animals and chickens. Plaster lath strips may be used. There should be a space of one or two inches between the lath strips.

Preparing the Soil. The soil over which the frame is to be placed should be fertilized with well rotted manure and spaded up to a depth of 10 inches or more. Where soil and water conditions are favorable for subirrigation, tile should be laid first. Two rows of tile, two to three feet apart laid at a depth of 10 inches, are recommended. If the frame garden is not subirrigated, watering may be done from a hose or even from a sprinkling pot.

Planting. The rows should be 8 to 12 inches apart, planting the narrow way to make cultivation easier. Large growing vegetables, such as bush beans, should have more space. In most areas several plantings of vegetables may be made. The following suggestions are offered for those who desire

to plant several times during the framing season. Low growing, quick maturing kinds and varieties are recommended. Keep seed on hand for replanting each row as rapidly as it is harvested.

The Texas A. & M. College Extension Service says that Texas farm families planted 10,241 frame gardens in 1939, an increase of 7,119 over the 1938 total of 3,122. These gardens yielded 2,125,000 pounds of vegetables valued at $112,000. Many produced three to five crops.

South America Welcomes Rubber Experts

Condensed from Extension Service Review

TRAVELING by airplane, steamship, gunboat, railroad scooters, muleback, and sometimes on foot, the first of four parties sent out by the Department of Agriculture to survey the possibilities of growing rubber in Latin America has completed its work and returned to Washington.

The party, led by Dr. E. C. Stakman, Chief of the Division of Plant Pathology and Botany, at the University of Minnesota, and agent of the United States Department of Agriculture, surveyed an area which covers roughly the headwaters of the Amazon tributaries east of the Andes in Peru, and an area west of the Andes in Ecuador and Colombia. Other members of the party were E. M. Blair, rubber technologist; M. M. Striker, soils specialist of the Bureau of Plant Industry; and A. F. Skutch, botanist. The group left last August.

My first question to Dr. Stakman was this: "How do the people you talked with feel about the United States?" His response was immediate and enthusiastic. "They are very friendly, and I talked with all classes, from the highest to the lowest. I don't see how anyone could have been more helpful to our party, and you can quote me on that. The Peruvian Government even turned over to us one of its river gunboats, and when we reached shallow water they had motorboats waiting to take us farther upstream. They provided guides, photographers, tree climbers, and general helpers. These people believe in Pan-American solidarity, but most of them realize that any lasting spirit of co-operation must be based on the mutual exchange of goods between North and South America. Exchange of salutes and felicitations is not enough."

Reprinted from the Extension Service Review, Washington, D. C.

Dr. Stakman and his associates had two objectives in mind. One was to discover likely looking locations for nurseries where Hevea seedlings could be propagated on a large scale. These seedlings will be used as rootstocks on which to multiply the superior strains of Hevea assembled by the Department from various sources, including the Orient. The other was to collect seeds and budwood from the wild rubber trees that might have potential value in the countries where they were collected. Incidentally, the rubber tree is budded or grafted in the same way as peach or apple trees.

Four locations were selected for nurseries—two in Peru, one in Colombia and one in Ecuador. These nurseries will become part of a chain extending throughout the tropical areas of Central and South America, and all countries participating in the program will share the superior strains already developed.

The Stakman party is one of four groups sent out last summer on similar missions. The others are in Central and South America now and will be coming back within the next month. These parties are the advance guard of a move to determine the feasibility of establishing commercial sources for rubber in the Western Hemisphere. The headquarters office, under the direction of Dr. E. W. Brandes, who is head of the Sugar Plants Division and the special rubber project in the Bureau of Plant Industry and an authority on tropical agriculture, will decide on locations for at least two large experimental stations in Latin America. At these stations problems of breeding, culture, and disease control will be tackled.

The rubber investigation was authorized by Congress last July and $500,000 was appropriated at that time. The Office of Foreign Agricultural Relations, under the direction of Dr. E. N. Bressman, is charged with the responsibility of co-ordinating the rubber work of the Department and also of other Federal executive departments and agencies. From the start the work has been conducted in co-operation with the Latin American republics that have suitable soil and climate for growing rubber tree.

Results of the rubber survey and experimental work that follows will be available to any cooperating tropical American republic, and to both large and small growers. Rubber is a crop that may be produced profitably by either large or small growers if conditions of soil, climate, and labor are right, and, if high-yielding, disease-free trees are planted. The rubber tree may be grown in any warm climate with a rainfall of at least 70 inches, well-distributed through the year. It thrives in a wide range of soils,

and after it has reached an age of 7 to 10 years may be tapped every few days for years without apparent damage to the tree.

Dr. Brandes and his associates believe that high-yielding strains of rubber now in the Americas will offset any labor advantage of the Far East, which is handicapped by an industry built upon low-yielding, seedling strains. Seedling trees average only about 300 pounds per acre. Good budded strains yield several times as much.

Rubber trees in tropical America are subject to the South American leaf disease, but there are high-yielding varieties that now appear to be sufficiently resistant to give promise of reducing the seriousness of this factor. These high-yielding, disease-resistant strains of rubber trees will be propagated and distributed from the experimental stations.

Under average conditions, it is estimated that large areas of the Americas could be in rubber production within 10 years. Much depends upon the survey and upon research to follow. If large areas are put into rubber production under the right conditions, increased production will be rapid. Rubber specialists say there are millions of acres in tropical America as well adapted to growing rubber as the 8,000,000 acres now in rubber in the Eastern Hemisphere.

This latest move to enable the Americas to supply a large part of their rubber needs is hastened by present international uncertainties. Although the United States uses more than half the annual world production of rubber, and has used as much as 80 percent, little of it is produced in the Western Hemisphere. The plantations of the Orient furnish about 97 percent of the world's rubber now, although as late as 1913 the tropical Americas furnished approximately half the world's rubber. Then "plantation" rubber from the Eastern Hemisphere began crowding out the "wild" rubber from the western world because of the advantages of cultivation and cheaper labor.

Although the Hevea rubber tree is a native of tropical America and is the original source of the world's cultivated rubber, the Americas produced only about 20,000 tons last year. Consumption of crude rubber in the United States last year was nearly 600,000 tons, more than half of which was used by the automobile industry.

Dr. Stakman and the others in his party have come back with a definite conviction that rubber can again become an important commercial crop in some areas of the countries they visited, provided there is sustained commercial and scientific co-operation. Dr. Stakman has been

pretty close to the rubber business for the last ten or twelve years. He has served as consultant on research for the Firestone plantations in Liberia, and has visited all the important rubber-growing areas of the world. Blair is a rubber technologist, formerly supervisor of field work on plantations of the United States Rubber Co. in Sumatra. Striker is a soils specialist, now in the Department. He has made soil surveys and land use studies in the Tropics, including Puerto Rico. Skutch is a botanist, who has spent the last twelve years in Central America, and is an authority on the vegetation of that region. Those in the other survey parties have had similar experience.

Corn Cost Goes Down as Acre Yields Go Up

YIELD per acre is obviously the most important single element in determining the net cost of producing a bushel of corn, according to analysis by the Department of Agriculture, published in Crops and Markets. Tabulated costs for 1938 by groups of States in which conditions are generally similar, show that in Illinois and Iowa with yields averaging 45 bushels to the acre, the cost averaged 47 cents a bushel in 1938. Ohio, Indiana, Michigan, Wisconsin, and Minnesota corn with a 40-bushel average cost 59 cents. With a yield of less than 15 bushels to the acre, the southeast was the high cost producing area, averaging $1.08 a bushel.

Seed cost averaged 82 cents an acre in Iowa and Illinois, just about double the cost—38 to 43 cents—outside the Corn Belt. This reflects the widespread use of the more expensive but more productive hybrid seed now available for the high yield areas. In the other Corn Belt States, seed cost averaged 68 cents an acre.

Net acre costs, including rent, fell into three distinct groups: $21.15 an acre for Iowa and Illinois, $22.31 for the Northeastern States, and $23.69 for the Corn Belt outside Illinois and Iowa. In other areas costs ranged between $12 and $16 an acre.

Land rent averaged $6.05 an acre in Iowa and Illinois, $4.83 in the rest of the Corn Belt, $4.67 in the Northeast, and from $2.37 to $3.57 elsewhere.

—*Better Crops With Plant Food*

Movement of Calcium in the Soil

Condensed from New Jersey Agriculture

A. W. Blair

Soil Chemist, Retired

IN the problem of maintaining soil fertility for the growing of good crops, calcium plays a most important part. Without calcium, plants cannot develop and reach normal maturity. In humid regions where the rainfall is fairly heavy, a serious deficiency of this element finally leads to extreme soil acidity, and this condition, uncorrected, soon leads to practical soil bankruptcy for general farm crops, most vegetable crops, and tree fruits.

In speaking of the importance of calcium in his chapter on "The Soil and Living Plant," Sir John Russell, noted British soil chemist, says: "The calcium body—which we may call the calcium complex in order to avoid committing ourselves to the unproved view that it is calcium aluminosilicate—is of fundamental importance to soil fertility. It alone seems to confer upon the soil the property of going into a desirable tilth. It is easily converted into a sodium complex by continued washing of the soil with a solution of sodium chloride or sodium nitrate, and the soil then completely changes its character; a sandy or gravelly soil becomes like concrete; a clay becomes a hopelessly sticky mass. If by some catastrophic blow all the calcium were removed from soil, the face of the earth would be greatly altered."

Fortunately for the farmer, such drastic changes do not occur, but less striking changes are going on constantly. For example, when cultivated land is flooded with sea water, the sodium in the sea water interacts with the calcium of the soil complex with a loss of calcium. Again, the use of irrigation waters containing sodium salts would have the same tendency; and if nitrate of soda is used in excessive amounts or continuously over long periods, the sodium of the nitrate tends to replace and drive out the calcium of the soil complex. This is one of the laws of chemistry and does not permit of argument. Thus a soil deficient in calcium and overcharged with sodium would be formed. Such a soil is inclined to run together, bake, and offer unnecessary re-

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sistance to growing plants, and cultivation is difficult. We say such a soil is in poor tilth.

Of a calcium soil, meaning a soil in which calcium ions predominate over sodium and hydrogen ions, Russell says: "This is the normal fertile soil of humid and temperate regions to which most methods of agriculture are adapted. It is neutral and stable, and its physical properties are eminently suitable to plant growth and to cultivation. It is the soil the farmer prefers. It forms on freezing or on drying a good crumb structure which is not destroyed by rain, and, in comparison with soils saturated with other bases, holds more water in the air-dry condition, and less under wet conditions. It can be cultivated over a larger range of moisture contents, is less sticky, more permeable, and therefore drains more easily. It can also accumulate neutral humus, which not only intensifies the desirable physical properties of the soil, but also renders it more fertile by acting as a reserve of plant nutrients. It forms a favorable environment for plant roots by maintaining good air and water conditions."

In the laboratory, calcium carbonate (limestone) appears to be insoluble in water. Even when finely ground, it dissolves with exceeding slowness. Not so in nature. Who has not marveled at the great caverns in the earth or the great gorge beneath Natural Bridge in Virginia, all of which owe their origin to the dissolving of limestone by ground waters? These waters, charged with carbonic and other acids, have a remarkable solvent effect on soil minerals. Analysis of any natural stream water proves this, and in limestone regions such water shows a rather high content of calcium.

It is not difficult to understand, then, that there is a constant tendency for calcium to be lost in the drainage waters. When limestone rock is pulverized and applied to the land, the soil solution (ground water), mildly charged with carbonic and other acids, begins to act upon it and bring it into solution. If this dissolved material is not used by the plant, it is gradually carried downward by percolating waters. Where fields have been regularly limed at intervals of 3 to 5 years, it is common to find the pH of the subsoil higher than the pH of the cultivated layer.

In fields and orchards where liming has been neglected for 15 or 20 years, it is not unusual to find the subsoil extremely acid. This, however, is due to poor liming practice and does not in any sense prove that lime does not move downward. In such cases it may not be amiss to spread the lime and plow it under in order that the acid condition of the subsoil may be more easily remedied.

When lime is applied regularly and consistently, especially if it is applied in the late summer or fall at the time of seeding cover crops, there will be a little question as to the proper distribution of the lime throughout the root zone.

Even with heavy grass sods and alfalfa, tests have shown that the acidity of the subsoil has been gradually reduced by surface applications of pulverized limestone at regular intervals.

In discussing gains and losses of plant nutrients through drainage Dr. Firman E. Bear says in his book "Theory and Practice in the Use of Fertilizers": "The losses through drainage in humid regions are, however, likely to more than counterbalance the gain from the subsoil through the action of capillarity. This is one very good reason for applying fertilizers, manure, and limestone to the surface of the soil, although the extent to which losses might occur in the presence of growing plants with deep root systems is problematical."

Of all the drainage losses, those of nitrogen and calcium are the most serious. Lysimeter work at Cornell has shown that about 560 pounds of ground limestone would be required to replace the yearly loss of calcium from an acre of cropped land and about 900 pounds to replace that lost from an acre of bare soil.

When tobacco was grown on Merrimac silt loam soil under lysimeter conditions by the Connecticut Experiment Station, with nitrogen from different sources, the average annual loss of calcium in drainage waters was equivalent to more than 550 pounds of limestone to the acre. Results similar to those from Cornell and Connecticut have been reported by the Rothamsted Experimental Station, England, and by other experiment stations in this country.

In arid and semiarid sections of this and other countries, where the rainfall is insufficient to maintain a constant downward movement of water, lime compounds tend to accumulate just below the A horizon or at greater depths, the amount of water falling on the land not being sufficient to carry it farther. With heavier rainfall, such accumulations do not occur, but, as already pointed out, the lime continues to move downward, and much of it is carried out into streams.

There is, therefore, abundant proof of the downward movement of lime compounds in cultivated soils in humid parts of the country. In good farm management and good liming practice, this downward movement of the lime will prevent the subsoil from becoming unduly acid. When the use of lime is neglected over a period of years, however, or where there is a very hard or impervious subsoil or plow sole,

it may become necessary to plow the lime under or spread it on the bottom of the plow furrow in order that the unfavorable conditions in the subsoil may be more easily corrected.

New Type Hog House Has Sunshine Features

TO replace the old-time A-type hog houses that have been used on swine farms for many years, the University of Illinois College of Agriculture has adopted a house of a different construction which has been appropriately named the Illinois "sunshine" house.

The design was conceived to combat the dark, musty interiors prevalent in other types of swine shelters, as well as to give the sow and her litter full benefit of the early spring sun while at the same time they are protected from the chill winds.

Plans drawn up by the college include two sizes of houses, a 7 by 14 foot shelter and a smaller 7 by 8 foot house. The front elevation of both houses is 6 feet and the rear elevation is 3 feet. The size best suited for a swine grower's needs will depend upon the number of sows he has available and the expense which he wishes to incur.

The front of the house is equipped with two pairs of folding doors which, when opened, let sunlight into the whole interior of the house. The same latch which holds each set of doors closed fits them back snugly against the side of the house when they are open. At night the doors fit tightly in such a manner that they easily serve as another wall. A hurdle connected with the floor by a wire fencing closes the open side when the doors are folded back. The entrance to the house is at one end.

One feature of this house is that it is equipped with runners so it can be easily pulled from one place to another. The floor and the sides are durable enough to withstand moving.

The lumber necessary to build the larger house runs close to 750 board feet, while the smaller house requires 470 board feet of lumber. For best results a good grade of lumber is recommended, and if matched lumber is used the houses are warm enough for farrowing purposes. All houses made at the college are of cypress lumber and are given two coats of paint.

If a swine grower wishes to use the house for farrowing purposes, it is a simple matter to fit guard rails around the inside to protect the pigs from being crushed.—By Dr. B. W. Fairbanks, University of Illinois

—Duroc News

Freezing for Better Living

Condensed from New England Homestead

R. P. Atherton

SHOULD you by chance drive down East Street in the little town of Litchfield, Connecticut, you would see a neat building at the foot of the hill labeled "Crutch Frozen Food Locker."

The locker plant system has fast taken the country by storm. A recent survey made public by the United States Department of Agriculture shows approximately 5000 storage plants in the United States. A large part of the growth of this new industry should be credited to state universities and different divisions of the United States Department of Agriculture. It has been through research conducted by these agencies that the proper conditions have been established for food preservation through freezing.

Farmers have always used the meat, vegetables and fruits produced on the farm as the basis of their food supply. This has been corned, dried, smoked and canned, but in most cases there has never been enough to last through the entire year.

The normal practice is to kill the pig or "veal" as soon as cold weather "sets in."

With a frozen food locker in the area you can butcher when the animal is ready to kill, whether it is summer or winter. The meat is taken directly to the plant after being butchered, where it is placed in a pre-cooling room at a temperature of about 37 degrees. This removes the animal heat and excess moisture. Then the meat goes into the cooler for aging which takes a few days or a few weeks, depending upon the kind, quantity and size of cuts. The temperature in this room is held at 34 degrees. The meat is cut up by an experienced butcher who is hired by the plant. The owner gives directions as to the size of cuts he wishes, kinds of cuts—so many roasts, so many steaks, pork chops, hamburg, and the meat packaged according to the weight that the family would normally utilize. Each is wrapped separately in special moisture resistant parchment paper and then covered with ordinary wrapping paper. Each package is labeled with the weight, kind of meat and the owner's name.

This meat is placed in special freezing compartments where the temperature drops to 20 degrees below zero! The meat is held in these compartments for 12 to 48 hours, depending upon the size and cut.

Each package is then placed in the individual's own locker which can be opened only by the plant

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operator and renter. The lockers, themselves, have the outside appearance of oversized filing cabinets. Each cabinet has five lockers, one over the other. The cabinets in the Litchfield storage plant are in a pit below the floor level of the room and are raised by a traveling electric crane hoist. The individual locker is 24 inches by 24 inches by 18 inches high. This gives an approximate capacity of six cubic feet. This space will accommodate from 200 to 225 pounds of meat packaged in small amounts and about 250 pounds of meat in larger cuts. Temperature of these lockers is zero and is maintained through refrigerant coils in the pit below the main floor. These coils are so arranged that each cabinet has one side adjoining the coils.

Pork may be kept from four to six months, which means pork chops most any time of the year. Beef may be kept from eight months to a year and one can be assured of a steak which normally sells for 45c per pound but only costs Mr. Consumer 18c per pound.

Someone asks, "Does one have to produce his own meat to have a locker?" By no means. But the first premise of a locker system largely depends on native meat. Although the operator will buy western meat at wholesale and only charge a small brokerage fee to the patrons, the real saving comes through the production and sale of native meat, whether or not it is to the farmer or urban dweller.

Locker costs vary and services rendered by the plant vary. Reports from the Middle West come to us of locker rents averaging $12.00 per year and processing from 1c to 2c per pound. This plant in Litchfield rents its lockers for $15.00 per year and charges 1½c per pound for processing. Processing includes storage in the cooler, cutting into desirable cuts, grinding, and wrapping in special paper, and locker service. When one considers that the average family will consume about 500 pounds of meat per year, and the saving is at least 10c per pound, then a real saving is made. This saving is increased when the consumer raises his own meat which costs him very little.

The possibilities of such storage lockers might well be summed up as follows:

1. It may well afford a better market for native meats, which will mean better meat grown locally and an increase in farm income.

2. It guarantees a saving to the individual whether he raises all of his own meat or purchases it.

3. It assures the farmer of a ready market for his steer, pig, etc., through his own family.

4. A real saving is affected on any farm where meat, fruits and vegetables can be produced and utilized by the farm family.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.
(See Farmers Digest, November, 1939)

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. Published by the Macmillan Co. $4.00.
(See Farmers Digest, July, 1940)

Breeding Your Own, or Raising Colts for Pleasure and Profit—By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Conservation in the United States—By Gustafson, Ries, Guise and Hamilton. Comstock Pub. Co. $3.00.
(See Farmers Digest, July, 1940)

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.
(See Farmers Digest, February, 1940)

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.
(See Farmers Digest, October, 1939)

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.
(See Farmers Digest, January, 1940)

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Eco., Iowa State Col.; pub. by Collegiate Press. $2.50.
(See Farmers Digest, October, 1940)

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.
(See Farmers Digest, January, 1941)

Livestock and Poultry Diseases—By W. A. Billings, Asst. Prof. of Vet. Medicine, Univ. of Minnesota. Macmillan Co. $3.50.
(See Farmers Digest, June, 1940)

Livestock Judging Handbook—By Julius E. Nordby, Asst. Prof. Animal Husb., Univ. Idaho, Bu. Animal Industry, 1938, and W. Malcolm Beeson, Ph.D., Asst. Prof. Animal Husb., Univ. Idaho. The Interstate Printers. $2.60.
(See Farmers Digest, February, 1941)

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.
(See Farmers Digest, July, 1939)

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.
(See Farmers Digest, September, 1939)

Poisonous Plants of the United States—By Walter Conrad Muenscher, Prof. Botany, Cornell. Macmillan Company. $3.50.
(See Farmers Digest, November, 1940)

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Co. $4.00.
(See Farmers Digest, September, 1940)

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U.S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.
(See Farmers Digest, December, 1940)

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw-Hill Book Co. $5.00.
(See Farmers Digest, May, 1940)

The Western Horse—Its Training, Type and Marketing. By John A. Gorman, Asso. Prof. Animal Production, Univ. of Wyoming. The Interstate Printers and Publishers. $1.65. (See Farmers Digest, March, 1941)

For the convenience of our readers, books listed may be purchased through this Department. Address C. Leavitt Dyer, Farmers Digest, Ambler, Pa.

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